MANAKULA VINAYAGAR
INSTITUTE OF TECHNOLOGY
An Autonomous Institution
Affiliated to Pondicherry University, Approved by AICTE, New Delhi,
Accredited by NAAC with 'A' Grade
Kalitheerthalkuppam, Puducherry- 605 107.

(An Autonomous Institution)

Curriculum and Syllabus

For

UG Degree Program

In

B.Tech

Electronics and Communication Engineering

(2025-26)

(First Year Curriculum)

SEMESTER I							
S.No	**Course Code**	**Course Title**	**C**	**L**	**T**	**P**	**Credits**
Induction Programme for 3 weeks							
Theory							
1	25UMAT11	Matrices and Calculus	BS	3	1	0	4
2	25UPHT12	Physical science for Electronics Engineers	BS	3	0	0	3
3	25UECT13	Electron Devices	PC	3	0	0	3
Integrated course							
4	25UECI14	Basic Sensors and Instrumentation	ES	2	0	4	4
5	25UHSI16	Professional Communication for Engineers	HS	1	0	4	3
Practical							
6	25UPHP12	Physical science Laboratory	BS	0	0	2	1
7	25UECP12	Electronic Devices Laboratory	PC	0	0	2	1
8	25UGEP19	Engineering Graphics and auto CAD	ES	0	0	2	1
Employability Enhancement Course							
9	25UPCE11	Career Development skills	EEC	0	0	2	0
Mandatory Course							
10	25UMCC11	IKS – Concepts and applications in Engineering and Science	MCC	0	0	2	0
Total Credits							**20**

SEMESTER II							
S.No	**Course Code**	**Course Title**	**C**	**L**	**T**	**P**	**Credits**
Theory							
1	25UMAT22	Partial Differential Equations and Transforms	BS	3	1	0	4
2	25UHST22	Universal Human Values II	HS	2	0	0	2
3	25UECT23	Fundamentals of Electrical Machines	ES	3	0	0	3
4	25UECT24	Electric and magnetic circuits	PC	3	0	0	3
Integrated course							
5	25UCSI26	Programming in C	ES	2	0	2	3
6	25UECI26	Digital Electronics	PC	3	0	2	4
Practical							
7	25UECP21	Electric Machines Laboratory	ES	0	0	2	1
8	25UECP22	Electronics Fabrication lab	ES	0	0	2	1
Employability Enhancement Course							
9	25UPCE21	Communication skills	EEC	0	0	2	0
10	25UCCC21	Certification Course I	CCC	0	0	4	0
Mandatory Course							
11	25UMCC21	IKS in Humanities and Social Science	MCC	0	0	1	0
12	25UMCC22	Holistic wellness	MCC	0	0	2	0
Total Credits							**21**

SEMESTER III							
S.No	**Course Code**	**Course Title**	**C**	**L**	**T**	**P**	**Credits**
Theory							
1	25UMAT36	Linear Algebra for scientific computing	BS	3	1	0	4
2	25UECT31	Signals and Systems	PC	2	1	0	3
3	25UECT32	Digital System Architecture and Design	PC	2	1	0	3
4	25UECT33	Electronic Circuits	PC	3	0	0	3
5	25UECT34	Green Electronics and sustainability	PC	3	0	0	3
Integrated course							
6	25UCSI32	Python for Engineers	ES	3	0	2	4
Practical							
7	25UECP31	Digital System Architecture and Design Lab	PC	0	0	2	1
8	25UECP32	Electronic Circuits Lab	PC	0	0	2	1
9	25UECP33	Design thinking Laboratory	PC	0	0	2	1
Employability Enhancement Course							
10	25UPCE31	Personality Development skills	EEC	0	0	2	0
11	25UCCCxx	Certification Course II	CCC	0	0	4	0
Mandatory Course							
12	25UMCC31	Indian Constitution and Human Rights	MCC	1	0	0	0
						Total Credits	**23**

SEMESTER IV							
S.No	**Course Code**	**Course Title**	**C**	**L**	**T**	**P**	**Credits**
Theory							
1	25UMAT41	Probability and Random Process for communication systems	BS	3	1	0	4
2	25UECT41	Microcontrollers	PC	2	1	0	3
3	25UECT42	Analog and Digital Communication	PC	3	0	0	3
4	25UECT43	Transmission Lines and Radiating systems	PC	3	0	0	3
5	25UECT44	Control systems	PC	3	0	0	3
Integrated course							
6	25UECI41	Linear Integrated Circuits	PC	2	1	2	4
Practical							
7	25UECP41	Microcontrollers Lab	PC	0	0	2	1
8	25UECP42	Analog and Digital Communication Lab	PC	0	0	2	1
9	25UECW41	Idea to Prototype	CEC	0	0	2	2
Employability Enhancement Course							
10	25UPCE41	Professionalism and basic aptitude	EEC	0	0	2	0
11	25UCCCxx	Certification Course III	CCC	0	0	4	0
Mandatory Course							
12	25UMCC41	SDG & Environmental Science	MCC	1	0	0	0
						Total Credits	**24**

SEMESTER V							
S.No	**Course Code**	**Course Title**	**C**	**L**	**T**	**P**	**Credits**
Theory							
1	25UECT51	Computer Networks	PC	3	0	0	3
2	25UECT52	IOT Systems	PC	2	1	0	3
3	25UECT53	VLSI design	PC	2	1	0	3
4	25UECT54	Digital Signal Processing	PC	2	1	0	3
5	25UECLXX	Professional Elective-1	PE	3	0	0	3
Integrated course							
6	25UECI51	Digital Coding Theory	PC	2	1	2	4
Practical							
7	25UECP51	VLSI Design Lab	PC	0	0	2	1
8	25UECP52	Computer communication and Digital Signal Processing Laboratory	PC	0	0	2	1
9	25UECP53	IOT Laboratory	PC	0	0	2	1
Employability Enhancement Course							
10	25UPCE51	Quantitative and verbal aptitude	EEC	0	0	2	0
11	25UCCCxx	Certification Course IV	CCC	0	0	4	0
Mandatory Course							
11	25UMCC51	IPR and commercialization	MCC	1	0	0	0
Total Credits							**22**

SEMESTER VI							
S.No	**Course Code**	**Course Title**	**C**	**L**	**T**	**P**	**Credits**
Theory							
1	25UECT61	Embedded Systems Design	PC	2	1	0	3
2	25UHST62	Technology Innovation and Management Entrepreneurship	HS	3	0	0	3
3	25UECT63	Wireless Communication and Networks	PC	3	0	0	3
4	25UECLXX	Professional Elective-2	PE	3	0	0	3
5	25UECOXX	Open Elective-1	OE	3	0	0	3
Integrated course							
6	25UECI61	RF communication systems	PC	3	0	2	4
Practical							
7	25UECP61	Mobile Communication Laboratory	PC	0	0	2	1
8	25UECP62	Embedded System Design Laboratory	PC	0	0	2	1
9	25UECW61	Capstone Project (Idea to Product)	CEC	0	0	4	2
Employability Enhancement Course							
10	25UPCE61	Analytical and reasoning skills	EEC	0	0	2	0
11	25UCCCxx	Certification Course V	CCC	0	0	4	0
Mandatory course							
12	25UMCC61	Professional Ethics	MCC	2	0	0	0
Total Credits							**23**

SEMESTER VII							
S.No	**Course Code**	**Course Title**	**C**	**L**	**T**	**P**	**Credits**
Theory							
1	25UHST71	Strategic Management for Engineers	HS	3	0	0	3
2	25UECT72	Microwave and Optical Engineering	PC	3	0	0	3
3	25UECLXX	Professional Elective3	PE	3	0	0	3
4	25UECLXX	Professional Elective-4	PE	3	0	0	3
Practical							
5	25UECP71	Microwave and Optical Engineering Lab	PC	0	0	2	1
6	25UECW71	Project Work Phase I	CEC	0	0	8	4
						Total Credits	**17**

SEMESTER VIII							
S.No	**Course Code**	**Course Title**	**C**	**L**	**T**	**P**	**Credits**
Theory							
1	25UECOXX	Open Elective-2	OE	3	0	0	3
2	25UECOXX	Open Elective -3	OE	3	0	0	3
Practical							
3	25UECW81	Project Work	CEC	0	0	16	8
4	25UEC	Internship	CEC	0	0	2	1
						Total Credits	**15**

Honors Courses

S.No	**Course Code**	**Course Title**	**C**	**L**	**T**	**P**	**Credits**
TRACK 1: VLSI Design							
1	25UECH51	CMOS Analog Circuit Design	HN	3	0	2	4
2	25UECH52	ASIC Design Methodology	HN	3	0	2	4
3	25UECH53	Low Power VLSI Design and SoC	HN	3	0	2	4
4	25UECH54	Physical Design and Verification	HN	3	0	2	4
5	25UECH55	VLSI Architectures for AI/ML	HN	3	0	2	4
TRACK 2: Advanced Communication							
1	25UECH61	Communication Theory	HN	3	0	2	4
2	25UECH62	Information Theory and Error Control Coding	HN	3	0	2	4
3	25UECH63	Modern Wireless Communication	HN	3	0	2	4
4	25UECH64	5G/6G Technologies and Beyond	HN	3	0	2	4
5	25UECH65	Optical and Quantum Communication	HN	3	0	2	4
						Total Credits (per Track)	**20**

MINOR COURSES OFFERED BY ECE DEPARTMENT

S.No	Course Code	Course Title	C	L	T	P	Credits
TRACK 1: Embedded Systems							
1	25UECM51	Fundamentals of Electronics and Digital Systems	MN	3	0	2	4
2	25UECM52	Microcontroller Architecture and Programming	MN	3	0	2	4
3	25UECM53	Embedded C and Real-Time Operating Systems	MN	3	0	2	4
4	25UECM54	ARM Processors and Embedded Linux	MN	3	0	2	4
5	25UECM55	Embedded Systems Design Project	MN	3	0	2	4
TRACK 2: VLSI and FPGA Design							
6	25UECM61	Fundamentals of Electronics and Digital Systems	MN	3	0	2	4
7	25UECM62	Digital Design with HDL	MN	3	0	2	4
8	25UECM63	FPGA Design and Prototyping	MN	3	0	2	4
9	25UECM64	ASIC Design Flow and Verification	MN	3	0	2	4
10	25UECM65	VLSI Design Project	MN	3	0	2	4
						Total Credits (per Track)	**20**

Semester-wise Credit Distribution

Semester	Total Credits
I	20
II	21
III	23
IV	24
V	22
VI	23
VII	17
VIII	15
TOTAL	**165**

Category-wise Course Distribution and Statistics

Basic Science Courses (BS)

Course Name	Semester	Credits
Matrices and Calculus	I	4
Physical Science for Electronics Engineers	I	3
Physical Science Laboratory	I	1
Partial Differential Equations and Transforms	II	4
Linear Algebra for Scientific Computing	III	4
Probability and Random Process for Communication Systems	IV	4
Total Basic Science Courses Credits:		20

Humanities and Social Sciences (HS)

Course Name	Semester	Credits
Professional Communication for Engineers	I	3
Universal Human Values II	II	2
Technology Innovation and Management Entrepreneurship	VI	3
Strategic Management for Engineers	VII	3
Total Humanities and Social Sciences Credits:		11

Engineering Science Courses (ES)

Course Name	Semester	Credits
Basic Sensors and Instrumentation	I	4
Engineering Graphics and Auto CAD	I	1
Fundamentals of Electrical Machines	II	3
Programming in C	II	3
Electric Machines Laboratory	II	1
Electronics Fabrication Lab	II	1
Python for Engineers	III	4
Total Engineering Science Courses Credits:		17

Professional Core Courses (PC)

Course Name	Semester	Credits

Electron Devices	I	3
Electronic Devices Laboratory	I	1
Electric and Magnetic Circuits	II	3
Digital Electronics	II	4
Signals and Systems	III	3
Digital System Architecture and Design	III	3
Electronic Circuits	III	3
Green Electronics and Sustainability	III	3
Digital System Architecture and Design Lab	III	1
Electronic Circuits Lab	III	1
Design Thinking Laboratory	III	1
Microcontrollers	IV	3
Analog and Digital Communication	IV	3
Transmission Lines and Radiating Systems	IV	3
Control Systems	IV	3
Linear Integrated Circuits	IV	4
Microcontrollers Lab	IV	1
Analog and Digital Communication Lab	IV	1
Computer Networks	V	3
IOT Systems	V	3
VLSI Design	V	3
Digital Signal Processing	V	3
Digital Coding Theory	V	4
VLSI Design Lab	V	1
Computer Communication and DSP Laboratory	V	1
IOT Laboratory	V	1
Embedded Systems Design	VI	3
Wireless Communication and Networks	VI	3
RF Communication Systems	VI	4
Mobile Communication Laboratory	VI	1
Embedded System Design Laboratory	VI	1
Microwave and Optical Engineering	VII	3

Microwave and Optical Engineering Lab	VII	1
Total Professional Core Courses Credits:		79

Professional Elective Courses (PE)

Course Name	Semester	Credits
Professional Elective-1	V	3
Professional Elective-2	VI	3
Professional Elective-3	VII	3
Professional Elective-4	VII	3
Total Professional Elective Courses Credits:		12

Open Elective Courses (OE)

Course Name	Semester	Credits
Open Elective-1	VI	3
Open Elective-2	VIII	3
Open Elective-3	VIII	3
Total Open Elective Courses Credits:		9

Core Enrichment Courses (CEC)

Course Name	Semester	Credits
Idea to Prototype(Sustainability Focus)	IV	2
Capstone Project (idea to Product)	VI	2
Project Work Phase I	VII	4
Project Work	VIII	8
Internship	VIII	1
Total Core Enrichment Courses Credits:		17

Employability Enhancement Courses (EEC)

Course Name	Semester	Credits
Career Development Skills	I	0
Communication Skills	II	0

Professional Development Skills	III	0
Professionalism and Basic Aptitude	IV	0
Quantitative and Verbal Aptitude	V	0
Analytical and Reasoning Skills	VI	0

Certification Courses (CCC)

Course Name	Semester	Credits
Certification Course I	II	0
Certification Course II	III	0
Certification Course III	VI	0
Certification Course IV	VI	0

Mandatory Courses (MCC)

Course Name	Semester	Credits
IKS - Concepts and Applications in Engineering and Science	I	0
IKS in Humanities and Social Science	II	0
Holistic Wellness	II	0
Indian Constitution and Human Rights	III	0
SDG and Environmental Science	IV	0
IPR and Commercialization	V	0
Professional Ethics	VI	0

Summary of Total Credits by Category

Category	Total Credits	Percentage
Basic Science Courses (BS)	20	12.42%
Humanities and Social Sciences (HS)	11	6.83%
Engineering Science Courses (ES)	17	10.56%
Professional Core Courses (PC)	79	46.58%
Professional Elective Courses (PE)	12	7.45%
Open Elective Courses (OE)	9	5.59%
Core Enrichment Courses (CEC)	17	10.56%
Employability Enhancement Courses (EEC)	0	0.00%
Certification Courses (CCC)	0	0.00%
Mandatory Courses (MCC)	0	0.00%
TOTAL	**165**	**100.00%**

Semester-wise Credit Distribution

Semester	Total Credits
I	20
II	21
III	23
IV	24
V	22
VI	23
VII	17
VIII	15
TOTAL	**165**

Syllabus
Semester I

<table>
<tr><td colspan="6">MATRICES AND CALCULUS</td></tr>
<tr><td colspan="6">(Common to All Branches)</td></tr>
<tr><td>Course Code:</td><td colspan="2">25UMAT11</td><td>Course Type:</td><td colspan="2">BS (Basic Science)</td></tr>
<tr><td>L : T : P:</td><td colspan="2">3 : 1 : 0</td><td>Credits:</td><td colspan="2">4</td></tr>
<tr><td>Total Periods:</td><td colspan="2">60</td><td>Evaluation:</td><td colspan="2">CAT: 40 + ESE: 60</td></tr>
<tr><td>Prerequisite:</td><td colspan="5">Higher Secondary Level Mathematics</td></tr>
<tr><td colspan="6">Course Objectives:</td></tr>
<tr><td colspan="6">To understand and gain the knowledge of matrix algebra, partial differentiation, double integration, triple integration and their application, curl, divergence. To familiar with vector differential operators, integral theorems (Green's, Stoke's, Gauss divergence).</td></tr>
<tr><td>Module I</td><td colspan="4">MATRICES</td><td>12 Hrs</td></tr>
<tr><td colspan="6">Eigenvalues and Eigen vectors of a real matrix, Characteristic equation, Properties of Eigen values and Eigenvectors - Cayley-Hamilton Theorem, Diagonalization of matrices. Reduction of a quadratic form to canonical form by orthogonal transformation - Nature of quadratic forms.</td></tr>
<tr><td rowspan="2">Teaching Learning Process</td><td colspan="5">Pedagogy: Chalk and Talk, PPT Presentations, Problem Solving Sessions, Tutorial Classes</td></tr>
<tr><td colspan="5">RBT Level: Theory: K1, K2, K3</td></tr>
<tr><td>Module II</td><td colspan="4">FUNCTIONS OF SEVERAL VARIABLES</td><td>12 Hrs</td></tr>
<tr><td colspan="6">Partial derivatives - Total derivative - Differentiation of implicit functions, Change of variables - Jacobians and their properties - Taylor's series for functions of two variables - Maxima and minima, Lagrange's method of undetermined multipliers.</td></tr>
<tr><td rowspan="2">Teaching Learning Process</td><td colspan="5">Pedagogy: Chalk and Talk, PPT Presentations, Problem Solving Sessions, Tutorial Classes</td></tr>
<tr><td colspan="5">RBT Level: Theory: K1, K2, K3</td></tr>
<tr><td>Module III</td><td colspan="4">INTEGRAL CALCULUS</td><td>12 Hrs</td></tr>
<tr><td colspan="6">Multiple Integral - Change of order of integration (Cartesian form). Applications: Areas as a double integral (Cartesian form) - Volume as a triple integral (Cartesian form).</td></tr>
<tr><td rowspan="2">Teaching Learning Process</td><td colspan="5">Pedagogy: Chalk and Talk, PPT Presentations, Problem Solving Sessions, Tutorial Classes</td></tr>
<tr><td colspan="5">RBT Level: Theory: K1, K2, K3</td></tr>
<tr><td>Module IV</td><td colspan="4">VECTOR DIFFERENTIATION</td><td>12 Hrs</td></tr>
<tr><td colspan="6">Scalar and vector valued functions - gradient, tangent plane - directional derivative - divergence and curl - scalar and vector potentials. Statement of vector identities - simple problems.</td></tr>
<tr><td rowspan="2">Teaching Learning Process</td><td colspan="5">Pedagogy: Chalk and Talk, PPT Presentations, Problem Solving Sessions, Tutorial Classes</td></tr>
<tr><td colspan="5">RBT Level: Theory: K1, K2, K3</td></tr>
<tr><td>Module V</td><td colspan="4">VECTOR INTEGRATION</td><td>12 Hrs</td></tr>
<tr><td colspan="6">Line, surface and volume integrals - statements of Green's, Stoke's and Gauss Divergence theorems - verification and evaluation of vector integrals using them.</td></tr>
<tr><td rowspan="2">Teaching Learning Process</td><td colspan="5">Pedagogy: Chalk and Talk, PPT Presentations, Problem Solving Sessions, Simulation (Python/Matlab/Scilab)</td></tr>
<tr><td colspan="5">RBT Level: Theory: K1, K2, K3</td></tr>
<tr><td colspan="5">Total Periods:</td><td>60</td></tr>
<tr><td colspan="6">Suggested Activities and Evaluation Methods:</td></tr>
</table>

Assessment Methodology	**Assessment Tools**	**Marks**
Test		25
Problem based Assignment	Moodle / Google form	5
Simulation (Python/Matlab/Scilab) Based Project assignment	Demo and viva	5

Attendance		5	
Total		40	

Course Outcomes:

On the successful completion of the course, students will be able to:

CO1: Find eigenvalues and eigenvectors, verify the Cayley-Hamilton theorem, and perform orthogonal diagonalization. (Apply)

CO2: Compute partial derivatives, determine total derivatives, Jacobians, employ Taylor's series, and find extremes of functions of two variables. (Apply)

CO3: Demonstrate proficiency in evaluating double integration and triple integration and using them to compute area and volume. (Apply)

CO4: Compute gradients, divergence, curl, directional derivatives, and apply vector identities to solve vector field problems. (Apply)

CO5: Apply Green's theorem, Stoke's theorem and Gauss divergence theorem. (Apply)

Textbooks:

T1: Veerarajan T., "Engineering Mathematics - I and II", Tata McGraw-Hill, New Delhi, 2014 and 2015.

T2: Dr. M.K. Venkataraman, "Engineering Mathematics - Volume I and Volume II", The National Publishing Company, Chennai 2008.

References:

R1: Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014.

R2: Ramana B.V., "Higher Engineering Mathematics", Tata McGraw-Hill, New Delhi, 2010.

R3: Bali N.P and Manish Goyal., "A Text Book of Engineering Mathematics", Laxmi Publications(P) Ltd, 2011.

R4: Erwin Kreyszig, Advanced Engineering Mathematics (9th Edition), John Wiley & Sons, New Delhi, 2011.

Web Resources:

1. https://nptel.ac.in/courses/111106100
2. https://nptel.ac.in/courses/111104125
3. https://nptel.ac.in/courses/111105121
4. https://nptel.ac.in/courses/111107112

CO-PO-PSO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	2	2
CO2	3	2	-	-	-	-	-	-	-	-	-	2	2
CO3	3	2	-	-	-	-	-	-	-	-	-	2	2
CO4	3	2	-	-	-	-	-	-	-	-	-	2	2
CO5	3	2	-	-	-	-	-	-	-	-	-	2	2
Average	3	2										2	2

PHYSICAL SCIENCE FOR ELECTRONICS ENGINEERS			
(Common to ECE)			
Course Code:	25UPHT12	**Course Type:**	BS (Basic Science)
L : T : P:	3 : 0 : 0	**Credits:**	3
Total Periods:	45	**Evaluation:**	CAT: 40 + ESE: 60
Prerequisite:	Higher Secondary Physics and Mathematics (Class XII level), Basic understanding of calculus and vector algebra		

Course Objectives:

• This course provides first-year Electronics and Communication Engineering students with fundamental physics concepts essential for understanding electronic devices and systems.

• The course bridges theoretical physics with practical electronics applications, covering electromagnetic theory, quantum mechanics basics, solid-state physics, optoelectronics, and emerging battery technologies.

• Students will develop a strong foundation in physical principles that govern electronic components, circuits, and modern energy storage systems.

Module I	**SOLID STATE PHYSICS**	**9 Hrs**
Crystal structures, lattice dynamics, band theory of solids, effective mass, density of states, Fermi-Dirac distribution, electrical and thermal conductivity.		
Teaching Learning Process	Pedagogy: Chalk and Talk, PPT Presentations, Animations, Virtual Lab Demonstrations	
	RBT Level: Theory: K1, K2, K3	
Module II	**QUANTUM MECHANICS FOR ELECTRONICS**	**9 Hrs**
Wave-particle duality, Schrödinger equation, quantum tunnelling, particle in a box, quantum wells, quantum dots, applications in electronic devices.		
Teaching Learning Process	Pedagogy: Chalk and Talk, PPT Presentations, Simulations, Problem Solving	
	RBT Level: Theory: K1, K2, K3	
Module III	**OPTOELECTRONICS AND PHOTONICS**	**9 Hrs**
Light-matter interaction, absorption and emission processes, Semiconductor physics of LEDs, laser diodes, photodetectors, optical fibers, photonic crystals.		
Teaching Learning Process	Pedagogy: Chalk and Talk, PPT Presentations, Lab Demonstrations, Industry Case Studies	
	RBT Level: Theory: K1, K2	
Module IV	**BATTERY TECHNOLOGY AND ENERGY STORAGE**	**9 Hrs**
Electrochemical principles, battery types (Li-ion, solid-state, fuel cells), energy density and power density, charging mechanisms, battery management systems, emerging technologies.		
Teaching Learning Process	Pedagogy: Chalk and Talk, PPT Presentations, Case Studies on EV Batteries, Guest Lectures	
	RBT Level: Theory: K1, K2	
Module V	**SOLAR CELLS AND PHOTOVOLTAIC TECHNOLOGY**	**9 Hrs**
Solar spectrum and photovoltaic effect, semiconductor band structure and photogeneration, types of solar cells: monocrystalline, polycrystalline, thin-film, emerging materials, fabrication basics and device physics, performance parameters: efficiency, fill factor, IV characteristics, applications: standalone and grid-connected systems, integration in electronics.		
Teaching Learning Process	Pedagogy: Chalk and Talk, PPT Presentations, Virtual Lab, Field Visit to Solar Plant	
	RBT Level: Theory: K1, K2	
Total Periods:		**45**

Suggested Activities and Evaluation Methods:

Assessment Methodology	Assessment Tools	Marks
Test		25
MCQ unit wise 10 questions	Moodle / Google form	5
Virtual lab based assignment	Demo and viva	5
Attendance		5
Total		40

Course Outcomes:

On the successful completion of the course, students will be able to:

CO1: Apply solid-state physics concepts and materials properties. (Apply)

CO2: Apply quantum mechanical principles to explain the behavior of electrons in semiconductors and electronic devices. (Apply)

CO3: Understand light-matter interaction and apply to optoelectronic devices. (Understand)

CO4: Understand electrochemical principles and battery technologies and its applications in modern electronic systems. (Understand)

CO5: Understand photovoltaic principles and solar cell technologies and their integration in electronic and power systems. (Understand)

Textbooks:

T1: Resnick, Robert, David Halliday, and Kenneth S. Krane. Physics for Scientists and Engineers. 5th ed. Hoboken, NJ: Wiley, 2019.

T2: Kittel, Charles. Introduction to Solid State Physics. 8th ed. Hoboken, NJ: Wiley, 2018.

References:

R1: Charles Kittel, Introduction to Solid State Physics, 8th ed. (Hoboken, NJ: Wiley, 2018).

R2: David J. Griffiths, Introduction to Quantum Mechanics, 2nd ed. (Upper Saddle River, NJ: Pearson Prentice Hall, 2004).

R3: Bahaa E. A. Saleh and Malvin Carl Teich, Fundamentals of Photonics, 3rd ed. (Hoboken, NJ: Wiley, 2019).

R4: David Linden and Thomas B. Reddy, Handbook of Batteries, 4th ed. (New York: McGraw-Hill, 2011).

R5: Jenny Nelson, The Physics of Solar Cells, 1st ed. (London: Imperial College Press, 2003).

R6: Martin A. Green, Third Generation Photovoltaics: Advanced Solar Energy Conversion, 1st ed. (Berlin: Springer, 2006).

Web Resources:

1. Solid State Physics - TU Delft OCW: https://ocw.tudelft.nl/courses/solid-state-physics/
2. Lectures on Solid State Physics - David Tong (Cambridge): https://www.damtp.cam.ac.uk/user/tong/solidstate.html
3. Quantum Physics I - MIT OpenCourseWare: https://ocw.mit.edu/courses/8-04-quantum-physics-i-spring-2013/
4. Quantum Mechanics for Everyone - GeorgetownX (edX): https://www.edx.org/course/quantum-mechanics-for-everyone

CO-PO-PSO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	1	1
CO2	3	3	-	-	-	-	-	-	-	-	-	1	1
CO3	3	3	-	-	-	-	-	-	-	-	-	1	1
CO4	3	3	-	-	2	-	2	-	-	-	-	1	-
CO5	3	2	-	-	3	-	2	-	-	-	-	1	-
Average	3	2			2.5		2					1	1

ELECTRON DEVICES

(Common to ECE)

Course Code:	25UECT13	**Course Type:**	PC (Professional Core)
L : T : P:	3 : 0 : 0	**Credits:**	3
Total Periods:	45	**Evaluation:**	CAT: 40 + ESE: 60
Prerequisite:	Higher Secondary Physics		

Course Objectives:

• To introduce components such as diodes, BJTs and FETs.
• To know the applications of devices.
• To know the switching characteristics of devices.

Module I	**DIODES**	**9 Hrs**

Diode - Static and Dynamic resistances, Equivalent circuit, Diffusion and Transition Capacitances, V-I Characteristics, Diode as a switch - switching times.

Teaching Learning Process	Pedagogy: Chalk and Talk, PPT Presentations, Circuit Simulations (TCAD, PSPICE, LTSpice)
	RBT Level: Theory: K1, K2, K3

Module II	**DIODE APPLICATIONS**	**9 Hrs**

Rectifier - Half Wave Rectifier, Full Wave Rectifier, Bridge Rectifier, Rectifiers with Capacitive and Inductive Filters, Clippers - Clipping at two independent levels, Clamper - Clamping Circuit Theorem, Clamping Operation, Types of Clampers.

Teaching Learning Process	Pedagogy: Chalk and Talk, PPT Presentations, Hobby Circuit Demonstrations, Simulation Projects
	RBT Level: Theory: K1, K2, K3

Module III	**BIPOLAR JUNCTION TRANSISTOR (BJT)**	**9 Hrs**

Principle of Operation, Common Emitter, Common Base and Common Collector Configurations, Transistor as a switch, switching times.

Teaching Learning Process	Pedagogy: Chalk and Talk, PPT Presentations, Circuit Analysis, Lab Correlation
	RBT Level: Theory: K1, K2, K3

Module IV	**JUNCTION FIELD EFFECT TRANSISTOR (FET)**	**9 Hrs**

Construction, Principle of Operation, Pinch-Off Voltage, Volt-Ampere Characteristic, Comparison of BJT and FET, FET as Voltage Variable Resistor, MOSFET, MOSFET as a capacitor.

Teaching Learning Process	Pedagogy: Chalk and Talk, PPT Presentations, Device Simulations, Comparative Analysis
	RBT Level: Theory: K1, K2, K3

Module V	**SPECIAL PURPOSE DEVICES**	**9 Hrs**

Zener Diode - Characteristics, Zener diode as Voltage Regulator, Principle of Operation - SCR, Tunnel diode, UJT, Varactor Diode, Photo diode, Solar cell, LED, Schottky diode.

Teaching Learning Process	Pedagogy: Chalk and Talk, PPT Presentations, Application Demos, Industry Case Studies
	RBT Level: Theory: K1, K2, K3

Total Periods:	**45**

Suggested Activities and Evaluation Methods:

Assessment Methodology	**Assessment Tools**	**Marks**
Test		25
Application based Hobby circuits	Presentations	5
Simulation (TCAD, PSPICE, LT SPICE) Project based assignment	Demo and viva	5
Attendance		5
Total		40

Course Outcomes:

On the successful completion of the course, students will be able to:

CO1: Apply V-I characteristics to analyze diode behavior in different operating conditions. (Apply)

CO2: Apply diode properties to design and analyze diode-based circuits for practical applications. (Apply)

CO3: Apply the principle of operation of Bipolar Junction Transistors (BJT) to explain their functioning in electronic circuits. (Apply)

CO4: Apply different biasing techniques to analyze BJT characteristics and determine operating points. (Apply)

CO5: Apply the construction and operation principles of Field Effect Transistors (FET) to analyze their characteristics in various circuit configurations. (Apply)

Textbooks:

T1: Boylestad, Robert L., and Louis Nashelsky. Electronic Devices and Circuit Theory. 11th ed. Pearson, 2013.

T2: Floyd, Thomas L. Electronic Devices. 10th ed. Pearson, 2017.

References:

R1: Millman, Jacob, and Christos C. Halkias. Integrated Electronics: Analog and Digital Circuits and Systems. McGraw-Hill, 1972.

R2: Sedra, Adel S., and Kenneth C. Smith. Microelectronic Circuits. 7th ed. Oxford University Press, 2014.

R3: Razavi, Behzad. Fundamentals of Microelectronics. 2nd ed. Wiley, 2013.

R4: Streetman, Ben G., and Sanjay Kumar Banerjee. Solid State Electronic Devices. 7th ed. Pearson, 2014.

Web Resources:

1. Electronic Devices and Circuits - MIT OCW: https://ocw.mit.edu/courses/6-012-microelectronic-devices-and-circuits-fall-2009/
2. Semiconductor Device Fundamentals - Khan Academy: https://www.khanacademy.org/science/electrical-engineering
3. Electronic Devices Tutorial - All About Circuits: https://www.allaboutcircuits.com/textbook/semiconductors/
4. Diode and Transistor Circuits - Electronics Tutorials: https://www.electronics-tutorials.ws/

CO-PO-PSO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	3	-	-	-	-	-	-	2	3	1
CO2	-	1	3	-	-	-	-	-	-	-	-	2	2	1
CO3	1	3	-	-	2	1	-	-	-	-	-	2	-	1
CO4	2	-	2	2	-	-	-	-	-	-	-	2	3	1
CO5	2	3	3	-	3	-	1	-	-	-	-	2	2	1
Average	2	2.25	2.6	2	2.6	1	1					2	2.5	1

<table>
<tr><td colspan="4">BASIC SENSORS AND INSTRUMENTATION</td></tr>
<tr><td colspan="4">(Integrated Course: Theory + Practical)</td></tr>
<tr><td>Course Code:</td><td>25UECI14</td><td>Course Type:</td><td>ES (Enabling Science)</td></tr>
<tr><td>L : T : P:</td><td>2 : 0 : 4</td><td>Credits:</td><td>4</td></tr>
<tr><td>Total Periods:</td><td>Theory: 36 + Lab: 44 = 80 Hours</td><td>Evaluation:</td><td>CAT: 40 + ESE: 60</td></tr>
<tr><td>Prerequisite:</td><td colspan="3">Higher Secondary Physics (Basic knowledge of electrical quantities - voltage, current, resistance)</td></tr>
<tr><td colspan="4">Course Objectives:</td></tr>
<tr><td colspan="4">• To introduce first-year students to the fundamental concepts of sensors, transducers, and basic instrumentation systems.
• To provide hands-on experience with common sensors used in engineering applications.
• To develop basic skills in measurement techniques and data acquisition.
• Students will gain foundational knowledge of how physical quantities are measured and converted into electrical signals for further processing.</td></tr>
<tr><td>Module I</td><td colspan="2">INTRODUCTION TO MEASUREMENT SYSTEMS</td><td>8T + 8L Hrs</td></tr>
<tr><td colspan="4">Theory: Basic measurement concepts, units and standards, measurement errors and uncertainties, accuracy and precision, static and dynamic characteristics of instruments, measurement system components.

Lab Experiments:
• Familiarization with basic measuring instruments
• Error analysis and calibration techniques
• Study of instrument specifications and datasheets</td></tr>
<tr><td rowspan="2">Teaching Learning Process</td><td colspan="3">Pedagogy: Chalk and Talk, PPT, Hands-on Lab Sessions, Datasheet Analysis, Calibration Exercises</td></tr>
<tr><td colspan="3">RBT Level: Theory: K1, K2, K3</td></tr>
<tr><td>Module II</td><td colspan="2">TEMPERATURE SENSORS</td><td>8T + 12L Hrs</td></tr>
<tr><td colspan="4">Theory: Temperature scales, thermal expansion principle, resistance temperature detectors (RTD), thermistors, thermocouples, IC temperature sensors, temperature measurement techniques.

Lab Experiments:
• Temperature measurement using thermistor
• Thermocouple characteristics and cold junction compensation
• LM35 IC temperature sensor interfacing
• Temperature monitoring system design</td></tr>
<tr><td rowspan="2">Teaching Learning Process</td><td colspan="3">Pedagogy: Chalk and Talk, PPT, Lab Experiments, Sensor Interfacing with Arduino, Mini Project</td></tr>
<tr><td colspan="3">RBT Level: Theory: K1, K2</td></tr>
<tr><td>Module III</td><td colspan="2">PRESSURE AND FORCE SENSORS</td><td>6T + 8L Hrs</td></tr>
<tr><td colspan="4">Theory: Pressure measurement principles, strain gauges, load cells, pressure transducers, piezoelectric sensors, applications in weight and force measurement.
Lab Experiments:
• Load cell calibration and measurement
• Strain gauge bridge circuits
• Pressure sensor interfacing and display</td></tr>
<tr><td rowspan="2">Teaching Learning Process</td><td colspan="3">Pedagogy: Chalk and Talk, PPT, Bridge Circuit Analysis, Calibration Techniques, Lab Experiments</td></tr>
<tr><td colspan="3">RBT Level: Theory: K1, K2, K3</td></tr>
<tr><td>Module IV</td><td colspan="2">DISPLACEMENT AND POSITION SENSORS</td><td>6T + 8L Hrs</td></tr>
<tr><td colspan="4">Theory: Linear and angular displacement measurement, potentiometric sensors, LVDT (Linear Variable Differential Transformer), encoders, proximity sensors, ultrasonic sensors.</td></tr>
</table>

Lab Experiments: • LVDT characteristics study • Ultrasonic distance measurement • Proximity sensor applications • Position measurement system			
Teaching Learning Process	Pedagogy: Chalk and Talk, PPT, Lab Experiments, Distance Measurement Projects, Automation Demos		
	RBT Level: Theory: K1, K2, K3, K4		
Module V	**LIGHT AND OPTICAL SENSORS**		**8T + 8L Hrs**
Theory: Light measurement principles, photodiodes, phototransistors, LDR (Light Dependent Resistor), photoelectric sensors, fiber optic sensors, applications in automation, analog-to-digital conversion basics, digital displays, data logging principles. Lab Experiments: • LDR characteristics and light measurement • Photodiode and phototransistor interfacing • Automatic street light control system • Light intensity measurement and display • Signal conditioning circuits for sensors • Mini Project			
Teaching Learning Process	Pedagogy: Chalk and Talk, PPT, Lab Experiments, Automation Projects, Mini Project Development		
	RBT Level: Theory: K2, K3, K4, K6		
Total Periods:			**Theory: 36 + Lab: 44 = 80 Hours**

Suggested Activities and Evaluation Methods:

Assessment Methodology	**Assessment Tools**	**Marks**
Test		25
Real time based Sensor application - mini project	Hardware demo and report	5
Instrumentation simulation (LabVIEW/Multisim)	Demo and viva	5
Attendance		5
Total		40

Course Outcomes:

On the successful completion of the course, students will be able to:

CO1: Apply basic principles of sensors, transducers, and measurement systems. (Apply)
CO2: Identify and classify different types of sensors based on their operating principles. (Understand)
CO3: Perform basic measurements using common sensors and display the results. (Apply)
CO4: Analyze sensor characteristics like accuracy, precision, and linearity. (Analyze)
CO5: Design simple sensor-based measurement circuits for practical applications. (Create)

Textbooks:

T1: Doebelin, Ernest O. Measurement Systems: Application and Design. 5th ed. McGraw-Hill, 2003.
T2: Morris, Alan S., and Reza Langari. Measurement and Instrumentation: Theory and Application. 2nd ed. Academic Press, 2015.

References:

R1: Bentley, John P. Principles of Measurement Systems. 4th ed. Pearson, 2005.
R2: Turner, James D., and Martin Hill. Instrumentation for Engineers and Scientists. Oxford University Press, 1999.
R3: Patranabis, D. Sensors and Transducers. 2nd ed. PHI Learning, 2003.
R4: Rangan, C.S., G.R. Sarma, and V.S.V. Mani. Instrumentation Devices and Systems. 3rd ed. McGraw Hill Education, 2014.

Web Resources:

1. Introduction to Sensors - National Instruments: https://www.ni.com/en-us/innovations/white-papers/06/introduction-to-sensors.html
2. Sensor Basics - Arduino: https://docs.arduino.cc/learn/electronics/sensors
3. Measurement and Instrumentation - MIT OCW: https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/
4. Sensors Tutorial - Electronics Tutorials: https://www.electronics-tutorials.ws/io/io_1.html
5. Basic Instrumentation - Khan Academy: https://www.khanacademy.org/science/physics

CO-PO-PSO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	-	-	-	-	-	-	-	-	2	2	1
CO2	3	1	-	-	-	-	-	-	-	-	-	2	2	1
CO3	3	3	2	-	-	-	-	-	-	-	-	2	2	1
CO4	3	-	-	-	-	-	-	-	-	-	-	2	2	1
CO5	3	3	3	-	-	-	-	-	-	-	-	2	2	1
Average	3	2.25	2.6	-	-	-	-	-	-	-	-	2	2	1

<table>
<tr><th colspan="5">PROFESSIONAL COMMUNICATION FOR ENGINEERS</th></tr>
<tr><th colspan="5">(Integrated Course: Theory + Lab)</th></tr>
<tr><td>Course Code:</td><td colspan="2">25UHSI16</td><td>Course Type:</td><td>HS (Humanities & Social Sciences)</td></tr>
<tr><td>L : T : P:</td><td colspan="2">1 : 0 : 4</td><td>Credits:</td><td>3</td></tr>
<tr><td>Total Periods:</td><td colspan="2">45</td><td>Evaluation:</td><td>CAT: 50 + ESE: 50</td></tr>
<tr><td>Prerequisite:</td><td colspan="4">Basics of English Language</td></tr>
<tr><td colspan="5">Course Objectives:</td></tr>
<tr><td colspan="5">• To improve the communicative competence of learners
• To learn to use basic grammatic structures in suitable contexts
• To acquire lexical competence and use them appropriately in a sentence and understand their meaning in a text
• To help learners use language effectively in professional contexts
• To develop learners' ability to read and write complex texts, summaries, articles, blogs, definitions, essays and user manuals</td></tr>
<tr><td>Module I</td><td colspan="3">INTRODUCTION TO COMMUNICATION</td><td>9 Hrs</td></tr>
<tr><td colspan="5">EFFECTIVE COMMUNICATION: What is effective communication? Why is communication critical for excellence during study, research and work? What are the seven C's of effective communication? What are key language skills? What is effective listening, speaking, reading, writing?

FUNDAMENTALS OF COMMUNICATION: Reading - Reading brochures (technical context), telephone messages / social media messages relevant to technical contexts and emails. Writing - Writing emails / letters introducing oneself. Grammar - Present Tense (simple and progressive); Question types: Wh/ Yes or No/ and Tags. Vocabulary - Synonyms; One word substitution; Abbreviations & Acronyms.

LAB ACTIVITY: Extempore (Oral), Conversation on asking directions, Listening - Telephone conversation; Speaking Self-introduction; Video conferencing etiquette.</td></tr>
<tr><td rowspan="2">Teaching Learning Process</td><td colspan="4">Pedagogy: Interactive Sessions, Role Play, Listening Exercises, Language Lab Activities, Peer Learning</td></tr>
<tr><td colspan="4">RBT Level: Theory: K1, K2</td></tr>
<tr><td>Module II</td><td colspan="3">NARRATION AND SUMMATION</td><td>9 Hrs</td></tr>
<tr><td colspan="5">Reading - Reading biographies, travelogues, newspaper reports, Excerpts from literature, and travel & technical blogs. Writing - Guided writing -- Paragraph writing Short Report on an event. Grammar - Past tense (simple); Subject-Verb Agreement; and Prepositions. Vocabulary - Word forms (prefixes & suffixes); Synonyms and Antonyms; Phrasal verbs.

LAB ACTIVITY: Listening - Travel podcast; Speaking - Narrating and sharing personal experiences through a podcast, Autobiography of a famous Personality.</td></tr>
<tr><td rowspan="2">Teaching Learning Process</td><td colspan="4">Pedagogy: Reading Exercises, Podcast Creation, Storytelling Sessions, Peer Review, Language Lab</td></tr>
<tr><td colspan="4">RBT Level: Theory: K1, K2</td></tr>
<tr><td>Module III</td><td colspan="3">DESCRIPTION OF A PROCESS / PRODUCT</td><td>9 Hrs</td></tr>
<tr><td colspan="5">Reading - Reading advertisements, gadget reviews; user manuals. Writing - Writing definitions; instructions; and Product/Process description. Grammar - Imperatives; Adjectives; Degrees of comparison; Present & Past Perfect Tenses. Vocabulary - Compound Nouns, Homonyms; and Homophones, discourse markers (connectives & sequence words).

LAB ACTIVITY: Listening - Railway / Airport Announcements, Travel Vlogs; Speaking - Describing a place or picture description.</td></tr>
<tr><td rowspan="2">Teaching Learning Process</td><td colspan="4">Pedagogy: Product Demo Sessions, Technical Writing Exercises, Audio-Visual Learning, Picture Description</td></tr>
<tr><td colspan="4">RBT Level: Theory: K1, K2</td></tr>
<tr><td>Module IV</td><td colspan="3">VISUALIZATION AND CLASSIFICATION</td><td>9 Hrs</td></tr>
<tr><td colspan="5">Listening - TED talks; Speaking - Interviewing a celebrity/Famous Personality; Reading - Company profiles, Business Letters; Vocabulary - Discourse Markers, Linking words and Phrases Collocation; Grammar - Pronouns, Conjunction, Preposition; Writing - Interpretation of Charts and Graphs.

LAB ACTIVITY: Picture Description, about purchasing a product, Summarizing a TED talk, Role play, Narrating an unforgettable event.</td></tr>
</table>

Teaching Learning Process	Pedagogy: TED Talk Analysis, Interview Simulations, Data Interpretation, Role Play Activities	
	RBT Level: Theory: K1, K2	
Module V	**EXPRESSION COMMUNICATION**	**9 Hrs**

Listening - Watching Movies / Listening to Dialogues and Conversations; Speaking - Role play, Panel Discussion, Debate; Reading - Blogs, Novels, Short Stories; Vocabulary - Phrasal Verbs; Grammar - Simple/Compound/Complex Sentences, Error Spotting, Punctuation; Writing - Descriptive Essay, Dialogue Writing.

LAB ACTIVITY: Listening /Reading Comprehension, Developing a story using given Vocabulary, Mini Presentation on General topic (ICT tools), Group Discussion.

Teaching Learning Process	Pedagogy: Group Discussions, Debates, Presentation Skills, Creative Writing, Language Lab Sessions
	RBT Level: Theory: K1, K2, K3, K4
Total Periods:	**45**

Suggested Activities and Evaluation Methods:

Assessment Methodology	**Assessment Tools**	**Marks**
Test		15
Listening and reading Comprehension	Online tool	5
Speaking assessment (Oral)	Review	10
Online assessment test	Online tool	10
Content creation Competition	Peer review	5
Attendance		5
Total		50

Course Outcomes:

On the successful completion of the course, students will be able to:

CO1: Use appropriate words in a professional context. (Understand)
CO2: Gain understanding of basic grammatic structures and use them in right context. (Understand)
CO3: Speak fluently and accurately in formal and informal communicative contexts. (Understand)
CO4: Write definitions, descriptions, narrations and essays on various topics. (Understand)
CO5: Express their opinions effectively in both oral and written medium of communication. (Analyze)

Textbooks:

T1: Raman, Meenakshi, and Sangeeta Sharma. Technical Communication: Principles and Practice. 3rd ed. New Delhi: Oxford University Press, 2015.
T2: Kumar, Sanjay, and Pushp Lata. Communication Skills. 2nd ed. New Delhi: Oxford University Press, 2015.
T3: Rizvi, M. Ashraf. Effective Technical Communication. 2nd ed. New Delhi: McGraw-Hill Education, 2017.

References:

R1: Lakshmi Narayanan. A Course Book on Technical English. Chennai: Scitech Publications (India) Pvt. Ltd. 2012.
R2: Viswamohan, Aysha. English for Technical Communication (With CD). 1st ed. New Delhi: McGraw-Hill Education.
R3: Kumar, Kulbhusan, and R. S. Salaria. Effective Communication Skill. 1st ed. New Delhi: Khanna Publishing House.
R4: Chellammal, V. Learning to Communicate. New Delhi: Allied Publishing House, 2003.

CO-PO Mapping:

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	-	-	-	-	-	-	1	2	3	2	-
CO2	-	-	-	-	-	-	1	2	3	2	-
CO3	-	-	-	-	-	-	1	2	3	2	-
CO4	-	-	-	-	-	-	1	2	3	2	-
CO5	-	-	-	-	-	-	1	2	3	2	-
Average	-	-	-	-	-	-	1	2	3	2	-

PHYSICAL SCIENCE LABORATORY

(Practical Only)

Course Code:	25UPHP12	**Course Type:**	BS (Basic Science - Lab)
L : T : P:	0 : 0 : 2	**Credits:**	1
Total Periods:	30 Hours	**Evaluation:**	CAT: 60 + ESE: 40
Prerequisite:	Basic knowledge of elasticity, heat conduction, light properties is essential.		

Course Objectives:

• To provide an experimental foundation for the theoretical concepts introduced in the lectures

• To help students understand the role of direct observation in physics and to distinguish between inferences based on theory and the outcomes of experiments

• To introduce the concepts and techniques which have a wide application in experimental science

List of Experiments:

1. Determination of Young's modulus of given material by non-uniform bending method.
2. Determination of viscosity of the given liquid using Poiseuille's method.
3. Determination of Thermal conductivity of a bad conductor - Lee's Disc method.
4. Determination of the thickness of a given thin material - Air wedge method.
5. Determination of the wavelength of Laser and particle size of given powder.
6. Determination of the angle of divergence of a laser beam using semiconductor.
7. Determination of band gap of a semiconductor diode.
8. Determination of radius of curvature of lens Newton's ring method.
9. Determination of the spectrometer grating/prism.
10. Determination of the optical fiber's numerical aperture and Acceptance angles.
11. Lattice structures and packing of spheres.
12. Potentiometry - determination of redox potentials and emfs.

Teaching Learning Process	Pedagogy: Demonstration, Hands-on Experiments, Data Analysis, Virtual Lab Simulations, STEM-based Model Creation
	RBT Level: Theory: K1, K2, K3

Suggested Activities and Evaluation Methods:

Assessment Methodology	**Assessment Tools**	**Marks**
Laboratory Conduction	Observation	10
Record work		10
Model exam		15
Viva		5
Virtual lab assignment	Review	5
STEM based model creation	Presentation	5
Attendance		10
Total		60

Course Outcomes:

On the successful completion of the course, students will be able to:

CO1: Apply the concepts of elasticity and beam bending to experimentally determine Young's modulus using the non-uniform bending setup. (Apply)

CO2: Apply the principles of fluid mechanics to experimentally determine the viscosity of a given liquid using Poiseuille's method. (Apply)

CO3: Apply the concept of steady-state heat conduction to experimentally determine the thermal conductivity of a bad conductor using Lee's Disc apparatus. (Apply)

CO4: Apply the principles of wave optics and interference to experimentally determine the thickness of a thin spacer using the Air Wedge method. (Apply)

CO5: Apply the principles of laser diffraction and wave optics to experimentally determine the wavelength of a laser beam and calculate the particle size of a fine powder. (Apply)

Textbooks:

T1: Melissinos, Adrian C., and Jim Napolitano. Experiments in Modern Physics. 2nd ed. Amsterdam: Academic Press, 2003.

T2: Preston, Daryl W. Experiments in Physics: A Laboratory Manual for Scientists and Engineers. New York: John Wiley & Sons, 1985.

T3: Srivastava, B. N., and R. C. Srivastava. A Textbook of Practical Physics. 11th ed. New Delhi: S. Chand & Company, 2014.

References:

R1: Millman, Samuel, ed. A Physicist's Desk Reference. 2nd ed. New York: American Institute of Physics, 1989.

R2: Bevington, Philip R., and D. Keith Robinson. Data Reduction and Error Analysis for the Physical Sciences. 3rd ed. Boston: McGraw-Hill, 2003.

R3: Born, Max, and Emil Wolf. Principles of Optics. 7th ed. Cambridge: Cambridge University Press, 1999.

R4: Senior, John M. Optical Fiber Communications: Principles and Practice. 3rd ed. Harlow: Prentice Hall, 2009.

Web Resources:

1. MIT OCW Experimental Physics: https://ocw.mit.edu/courses/physics/8-13-14-experimental-physics-i-ii-junior-lab/
2. Colorado Physics Lab: https://www.colorado.edu/physics/undergraduate/laboratory-courses
3. Newport Optical Tutorials: https://www.newport.com/n/optical-tutorials

CO-PO-PSO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	-	-	1	1	-	-	-	-	-	1	1
CO2	2	2	-	-	1	1	-	-	-	-	-	1	1
CO3	2	2	-	-	1	1	-	-	-	-	-	1	1
CO4	2	1	-	-	1	-	-	-	-	-	-	1	1
CO5	2	2	-	-	1	-	-	-	-	-	-	1	1
Average	2.2	2	-	-	1	1	-	-	-	-	-	1	1

ELECTRONIC DEVICES LABORATORY

(Practical Only)

Course Code:	25UECP12	**Course Type:**	PC (Professional Core - Lab)
L : T : P:	0 : 0 : 2	**Credits:**	1
Total Periods:	30 Hours	**Evaluation:**	CAT: 60 + ESE: 40
Prerequisite:	Basic knowledge of electrical circuits and Ohm's law, Understanding of DC and AC quantities, Familiarity with basic measuring instruments		

Course Objectives:

• To provide hands-on experience with semiconductor devices and their characteristics.
• To develop practical skills in analyzing and designing basic electronic circuits using diodes, BJTs, and FETs.
• To understand the behavior of electronic devices under different operating conditions through experimental verification.

List of Experiments:

1. To plot and analyze the forward and reverse bias V-I characteristics of PN junction diode and determine its parameters.
2. To study Zener diode characteristics in reverse bias and design a voltage regulator circuit.
3. To design and analyze half-wave and full-wave rectifier circuits and compare their performance parameters.
4. To plot input and output characteristics of BJT in common emitter configuration and determine its parameters.
5. To analyze different biasing techniques for BJT, determine Q-point, and compare their stability.
6. To study BJT as a small signal amplifier and measure voltage gain in common emitter configuration.
7. To demonstrate switching action of BJT and design practical switching circuits.
8. To plot drain and transfer characteristics of Junction Field Effect Transistor and determine its parameters.
9. To study the drain characteristics of Enhancement mode MOSFET and determine threshold voltage.
10. To design and test FET-based common source amplifier and measure its performance parameters.
11. To compare the characteristics, parameters, and applications of diode, BJT, and FET devices.
12. To design and implement a practical electronic circuit using semiconductor devices and demonstrate integrated learning.

Teaching Learning Process	Pedagogy: Demonstration, Hands-on Experiments, Circuit Construction, Virtual Lab Simulations, Mini Projects
	RBT Level: Theory: K2, K3

Suggested Activities and Evaluation Methods:

Assessment Methodology	**Assessment Tools**	**Marks**
Laboratory Conduction	Observation	10
Record work		10
Model exam		15
Viva		5
Virtual lab assignment	Review	5
Circuit Construction Task	Demo	5
Attendance		10
Total		60

Course Outcomes:

On the successful completion of the course, students will be able to:

CO1: Apply V-I characteristics to analyze diode behavior in different operating conditions. (Apply)
CO2: Apply diode properties to design and analyze diode-based circuits for practical applications. (Apply)
CO3: Apply the principle of operation of Bipolar Junction Transistors (BJT) to explain their functioning in electronic circuits. (Apply)
CO4: Apply different biasing techniques to analyze BJT characteristics and determine operating points. (Apply)
CO5: Apply the construction and operation principles of Field Effect Transistors (FET) to analyze their characteristics in various

circuit configurations. (Apply)

Textbooks:

T1: Boylestad, Robert L., and Louis Nashelsky. Electronic Devices and Circuit Theory. 11th ed. Pearson, 2013.
T2: Floyd, Thomas L. Electronic Devices. 10th ed. Pearson, 2017.

Web Resources:

1. Electronic Devices and Circuits - MIT OCW: https://ocw.mit.edu/courses/6-012-microelectronic-devices-and-circuits-fall-2009/
2. Semiconductor Device Fundamentals - Khan Academy: https://www.khanacademy.org/science/electrical-engineering
3. Electronic Devices Tutorial - All About Circuits: https://www.allaboutcircuits.com/textbook/semiconductors/
4. NPTEL Electronic Devices: https://nptel.ac.in/courses/117/106/117106030/

CO-PO-PSO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	-	-	1	1	-	-	-	-	-	1	1
CO2	2	2	-	-	1	1	-	-	-	-	-	1	1
CO3	2	2	-	-	1	1	-	-	-	-	-	1	1
CO4	2	1	-	-	1	1	-	-	-	-	-	1	1
CO5	2	2	-	-	1	-	-	-	-	-	-	1	1
Average	2.2	2	-	-	1	1	-	-	-	-	-	1	1

ENGINEERING GRAPHICS AND AUTO CAD

(Practical Only)

Course Code:	25UGEP19	**Course Type:**	ES (Enabling Science - Lab)
L : T : P:	0 : 0 : 2	**Credits:**	1
Total Periods:	30 Hours	**Evaluation:**	CAT: 60 + ESE: 40
Prerequisite:	Fundamental understanding of engineering mathematics and basic geometric concepts		

Course Objectives:

- To develop knowledge of standard practices in engineering drawing, including lettering, line work, dimensioning, and projection techniques.
- To enable students to construct and interpret conic sections, spirals, involutes, helix curves, and projections of points, lines, planes, and solids.
- To understand the development and intersection of surfaces like cylinder-cylinder and cylinder-cone, essential for fabrication and design.
- To build skills in creating accurate isometric and orthographic projections for effective engineering communication.
- To introduce students to AutoCAD for creating 2D engineering drawings, enhancing their ability to use modern engineering tools.

Unit I — BASICS AND CURVES

Introduction to Standards for Engineering Drawing practice, Lettering, Line work and Dimensioning. Conic sections, Involutes, Spirals, Helix. Projection of Points, Lines and planes.

Teaching Learning Process	Pedagogy: Demonstration, Hands-on Drawing Practice, Drawing Board Exercises
	RBT Level: Theory: K1, K2, K3

Unit II — PROJECTION OF SOLIDS

Projection of Solids and Sections of solids.

Teaching Learning Process	Pedagogy: Demonstration, 3D Model Visualization, Drawing Practice
	RBT Level: Theory: K1, K2, K3, K4

Unit III — DEVELOPMENT OF SURFACES

Development of surfaces.

Teaching Learning Process	Pedagogy: Demonstration, Physical Model Making, Sheet Metal Applications
	RBT Level: Theory: K1, K2, K3, K4

Unit IV — ISOMETRIC AND ORTHOGRAPHIC PROJECTIONS

Isometric projections and Conversion of pictorial to Orthographic views.

Teaching Learning Process	Pedagogy: Demonstration, View Conversion Exercises, Real Model Drawing
	RBT Level: Theory: K1, K2, K3, K4

Unit V — COMPUTER AIDED DRAFTING

Computer Aided Drafting: Introduction to Computer Graphics and Drafting, AutoCAD, 2-D diagrams of simple geometries using AutoCAD script.

Teaching Learning Process	Pedagogy: CAD Lab Sessions, AutoCAD Tutorials, Hands-on Software Practice, CAD Simulation Tests
	RBT Level: Theory: K1, K2, K3, K4

Suggested Activities and Evaluation Methods:

Assessment Methodology	Assessment Tools	Marks
Laboratory Conduction	Observation	10
Record work		10

Model exam		15
Viva		5
Real Model Drawing	Review	5
CAD Simulation Test		5
Attendance		10
Total		60

Course Outcomes:

On the successful completion of the course, students will be able to:

CO1: Apply the principles of engineering drawing standards, including lettering, line types, dimensioning, and accurately construct conic sections, spirals, involutes, and helix curves. (Apply)

CO2: Interpret and generate projections of solid objects and their sectional views, aiding in better understanding of internal features in engineering components. (Analyze)

CO3: Develop the lateral surfaces of solids essential for manufacturing and fabrication processes. (Analyze)

CO4: Create and interpret isometric and orthographic projections of engineering objects to effectively communicate design intent. (Analyze)

CO5: Utilize computer-aided drafting tools, particularly AutoCAD, to produce accurate 2D engineering drawings of simple geometries. (Analyze)

Textbooks:

T1: K.R. Gopalakrishna and Sudhir Gopalakrishna, Engineering Graphics, Inzinc Publishers, 2007.

References:

R1: N.D. Bhatt, Engineering Drawing, 49th edition, Chorotar Publishing House, 2006.

R2: K. Venugopal, Engineering Drawing and Graphics + AutoCAD, 4th edition, New Age International Publication Ltd., 2004.

R3: David Icook and Robert N Mc Dougal, Engineering Graphics and Design with computer applications, Holt - Sounders Int. Edn., 1985.

R4: James D Bethune et al., Modern Drafting, Prentice Hall Int., 1989.

Web Resources:

1. https://nptel.ac.in/courses/112/103/112103019/
2. https://archive.org/details/engineeringdrawingndbhatt

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	2	1	-	-	-	-	-	-	2
CO2	2	2	2	1	-	-	-	-	-	-	2
CO3	2	2	2	1	-	-	-	-	-	-	2
CO4	2	2	2	1	-	-	-	-	-	-	2
CO5	2	2	2	2	-	-	-	-	-	-	2
Average	2	2	2	1.2	-	-	-	-	-	-	2

CAREER DEVELOPMENT SKILLS

(Zero Credit - Employability Enhancement Course)

Course Code:	25UPCE11	**Course Type:**	EEC (Employability Enhancement)
L : T : P:	2 : 0 : 0	**Credits:**	0 (Zero Credit)
Total Periods:	48 Hours	**Evaluation:**	Internal Assessment: 100
Prerequisite:	Basic communication skills and foundational knowledge of workplace behavior.		

Unit 1	**CAREER PLANNING AND GOAL SETTING**	**10 Hrs**

Career Planning: Introduction to Career Planning - Self-Assessment for Career Planning - Exploring Career Options - Developing a Career Plan.

Goal Settings: Understanding Goal Setting - Setting Effective Goals - Action Plan Development - Practical Exercises.

Teaching Learning Process	Pedagogy: Interactive Sessions, Self-Assessment Tools, Goal Setting Workshops, Action Plan Exercises
	RBT Level: Theory:

MODULE II	**MOTIVATION AND PERSONALITY EFFECTIVENESS**	**10 Hrs**

Motivation - I: Definition and Importance of Motivation - Types of Motivation - Theories of Motivation - Factors Affecting Motivation.

Personality Effectiveness: Components of Personality Effectiveness - Communication Skills - Interpersonal Skills - Practical Exercises.

Building Personality and Discipline: Introduction to Personality Development - Building Positive Habits - Discipline and Self-Control - Practical Application.

Teaching Learning Process	Pedagogy: Motivational Videos, Role Plays, Personality Assessment, Habit Tracking Activities
	RBT Level: Theory: \

MODULE III	**GROOMING, HYGIENE AND PROFESSIONAL BEHAVIOR**	**10 Hrs**

Grooming, Hygiene and Cleanliness: Personal Hygiene Practices - Body Grooming Techniques - Environmental Cleanliness - Mental and Social Impact of Grooming and Hygiene.

Attitudes, Manners and Behaviour: Understanding Attitudes - Developing Positive Attitudes - Manners and Etiquette - Procedures and Protocols.

Teaching Learning Process	Pedagogy: Demonstrations, Etiquette Workshops, Professional Dress Code Sessions, Practical Demos
	RBT Level: Theory:

MODULE IV	**SELF-AWARENESS AND MANAGEMENT SKILLS**	**10 Hrs**

Self-Awareness & Self Confidence: Introduction to Self-Awareness - Understanding Strengths and Weaknesses - Building Self-Confidence - Practical Application.

Time Management: Introduction to Time Management - Planning and Prioritizing Tasks - Overcoming Procrastination - Practical Time Management.

Stress Management: Understanding Stress - Stress Management Techniques - Coping Strategies - Practical Application.

Emotional Intelligence: Introduction to Emotional Intelligence - Managing Emotions - Social Awareness and Relationship Management - Practical Exercises.

Teaching Learning Process	Pedagogy: SWOT Analysis, Time Management Tools, Stress Relief Activities, EI Assessment, Projects
	RBT Level: Theory:

MODULE V	**HIGHER EDUCATION AND ENTREPRENEURSHIP**	**8 Hrs**

Introduction to Higher Education, Competitive Exams: Overview of Higher Education - Competitive Exams Overview - Exam Preparation Techniques.

Introduction to Entrepreneurship: Understanding Entrepreneurship - Developing a Business Idea - Business Planning.

Teaching Learning Process	Pedagogy: Guest Lectures, Exam Preparation Workshops, Business Idea Presentations, Case Studies
	RBT Level: Theory:

Total Periods:	**48 Hours**

Suggested Activities and Evaluation Methods:

Assessment Methodology	**Assessment Tools**	**Marks**

Career Development Portfolio	Assignment	20
Personality Development Assignment	Assignment	20
Goal Setting and Action Plan	Project	15
Grooming and Etiquette Demonstration	Practical/Demo	15
Time and Stress Management Project	Project	20
Attendance and Class Participation	Continuous Assessment	10
Total		100

Course Outcomes:

On the successful completion of the course, the students will be able to:

CO1: Help students assess themselves, explore career options, and set actionable goals through structured planning.
CO2: Develop motivation, enhance personality effectiveness, and instill discipline for personal and professional growth.
CO3: Build awareness and practice of grooming, hygiene, positive attitudes, manners, and professional behavior.
CO4: Strengthen self-awareness, time and stress management, and emotional intelligence for balanced personal development.
CO5: Introduce students to higher education paths, competitive exams, and the fundamentals of entrepreneurship and business planning.

Textbooks:

T1: Dr. T. Kalyana Chakravathi, Soft Skills for Managers.
T2: Barun K Mitra, Personal Development and Soft Skills, Oxford Higher Education.

References:

R1: Daniel Goleman, The Emotionally Intelligent Workplace.
R2: E. Suresh Kumar, P. Sreehari, J Savithri, Communication Skills and Soft Skills - An Integrated Approach.
R3: Charles T. Rajendra, Top Talking in English (International Communication Skills).
R4: Raj Lakshmi Suryavanshi, Soft Skills, Gurucool Publishing.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	-	-	-	-	-	-	2	2	2	2
CO2	-	-	-	-	-	-	-	2	2	2	2
CO3	-	-	-	-	-	-	-	2	2	2	2
CO4	-	-	-	-	-	-	-	2	2	2	2
CO5	-	-	-	-	-	-	-	2	2	2	2
Average	-	-	-	-	-	-	-	2	2	2	2

IKS - CONCEPTS AND APPLICATIONS IN ENGINEERING AND SCIENCE			
(Zero Credit - Mandatory Credit Course)			
Course Code:	25UMCC11	**Course Type:**	MCC (Mandatory Credit Course)
L : T : P:	0 : 0 : 2	**Credits:**	0 (Zero Credit)
Total Periods:	30 Hours	**Evaluation:**	Internal Assessment: 100
Prerequisite:	Basic understanding of science and engineering fundamentals		

Course Objectives:

This course introduces students to the rich heritage of Indian Knowledge Systems (IKS) and their contemporary applications in engineering and science. The objective is to:

- Familiarize students with traditional Indian knowledge systems and their scientific foundations
- Explore the integration of ancient wisdom with modern engineering practices
- Understand sustainable technologies and innovations rooted in Indian traditions
- Develop appreciation for indigenous knowledge in solving contemporary challenges
- Foster research mindset towards validating and modernizing traditional practices

Unit I	INTRODUCTION TO INDIAN KNOWLEDGE SYSTEMS	6 Hrs
Historical overview of Indian Knowledge Systems - Scientific methodology in ancient India - Major texts and scholars: Vedas, Upanishads, Charaka Samhita, Sushruta Samhita - Transmission and preservation of knowledge - Contemporary relevance and global recognition.		
Teaching Learning Process	Pedagogy: Interactive Lectures, Documentary Screening, Discussion Forums, Heritage Site Visits	
	RBT Level: Theory:	
Unit II	**MATHEMATICS AND ASTRONOMY IN ANCIENT INDIA**	**6 Hrs**
Indian contributions to mathematics: Zero, decimal system, trigonometry - Aryabhata, Brahmagupta, Bhaskara's contributions - Astronomical observations and calendar systems - Navigation techniques and geographical knowledge - Applications in modern engineering calculations.		
Teaching Learning Process	Pedagogy: Lectures, Problem Solving using Ancient Methods, Planetarium Visits, Comparative Studies	
	RBT Level: Theory:	
Unit III	**METALLURGY, MATERIALS, AND ARCHITECTURE**	**6 Hrs**
Ancient Indian metallurgy: Iron pillar of Delhi, Wootz steel - Traditional building materials and techniques - Architectural marvels: Structural engineering principles - Water harvesting and management systems - Sustainable construction practices.		
Teaching Learning Process	Pedagogy: Case Studies, Field Visits to Heritage Sites, Model Demonstrations, Guest Lectures	
	RBT Level: Theory:	
Unit IV	**MEDICINE, AGRICULTURE, AND LIFE SCIENCES**	**6 Hrs**
Ayurveda: Principles and scientific validation - Traditional agricultural practices and crop management - Biodiversity conservation methods - Food preservation techniques - Biotechnology applications in traditional practices.		
Teaching Learning Process	Pedagogy: Demonstrations, Herbal Garden Visits, Scientific Validation Exercises, Project Work	
	RBT Level: Theory:	
Unit V	**INTEGRATION WITH MODERN SCIENCE AND TECHNOLOGY**	**6 Hrs**
Validating traditional knowledge through modern scientific methods - Case studies of successful IKS-modern science integration - Intellectual property and traditional knowledge protection - Research opportunities and career prospects - Future directions and challenges.		

Teaching Learning Process	Pedagogy: Research Paper Analysis, Innovation Proposals, Expert Interactions, Presentations
	RBT Level: Theory:

Total Periods:	**30 Hours**

Suggested Activities and Evaluation Methods:

Assessment Methodology	**Assessment Tools**	**Marks**
Major IKS Integration Project	Project	20
Traditional Knowledge Practical Demonstration	Practical/Demo	20
Scientific Validation Assignment	Assignment	15
Heritage Site/Museum Field Report	Field Work	15
Innovation Proposal Presentation	Presentation	20
Attendance and Lab Participation	Continuous Assessment	10
Total		100

Course Outcomes:

On the successful completion of the course, students will be able to:
CO1: Understand the historical development and scientific basis of Indian Knowledge Systems.
CO2: Analyze traditional Indian practices in mathematics, astronomy, metallurgy, and medicine.
CO3: Apply IKS principles to contemporary engineering and scientific problems.
CO4: Evaluate the sustainability aspects of traditional Indian technologies.
CO5: Create innovative solutions by integrating traditional knowledge with modern science.

Textbooks:

T1: Subhash Kak, "The Nature of Physical Reality", Mount Meru Publishing, 2016.
T2: B.V. Subbarayappa, "Indian Astronomy: A Source Book", Nehru Centre, 2008.
T3: Kapila Vatsyayan, "Traditional Indian Art and Culture", Cambridge University Press, 2015.

References:

R1: P.P. Divakaran, "The Mathematics of India: Concepts, Methods, Connections", Springer, 2018.
R2: S.N. Sen, "Ancient Indian History and Civilization", New Age International, 2010.
R3: National Mission for Manuscripts - www.namami.gov.in
R4: Digital Library of Traditional Ecological Knowledge - www.frlht.org
R5: CSIR Traditional Knowledge Digital Library - www.tkdl.res.in

CO-PO-PSO Mapping:

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	-	-	-	-	-	2	-	2	-	-	-	3	-
CO2	-	-	-	-	-	3	-	2	-	-	-	3	-
CO3	-	-	-	-	-	3	-	2	-	-	-	2	-
CO4	-	-	-	-	-	2	-	3	-	-	-	3	-
CO5	-	-	-	-	-	3	-	3	-	-	-	2	-
Average	-	-	-	-	-	2.6	-	2.4	-	-	-	2.6	-

Syllabus
Semester II

PARTIAL DIFFERENTIAL EQUATIONS AND TRANSFORMS

(Common to ECE)

Course Code:	25UMAT22	**Course Type:**	BS
Teaching Periods / Week (L:T:P):	3:1:0	**Credits:**	4
Total Teaching Periods:	60	**CAT + ESE Marks:**	40 + 60
Teaching Department:	Mathematics		

Course Objectives:

To introduce mathematical tools to solve first order differentiation equations.
To gain knowledge of problem-solving techniques of PDE.
To understand concept of the Laplace transform.
To inculcate the computation knowledge in Laplace transforms.
To acquaint with Fourier Transform techniques used in a wide variety of situations involving functions that are not necessarily periodic.

MODULE I	**ORDINARY DIFFERENTIAL EQUATIONS**	**Periods**	12 Hrs

Differential Equations (Higher order): Linear differential equations of higher order – with constant coefficients, the operator D, Euler's linear equation of higher order with variable coefficients - simultaneous linear differential equations, solution by variation of parameters method.

Teaching Learning Process	Pedagogy: Chalk and Talk, PPT, Problem solving
	RBT Level: Theory: K2, K3

MODULE II	**PARTIAL DIFFERENTIAL EQUATIONS**	**Periods**	12 Hrs

Formation of partial differential equations- Solutions of standard types of first order partial differential equations- Lagrange's linear equation- Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

Teaching Learning Process	Pedagogy: Chalk and Talk, PPT, Problem solving
	RBT Level: Theory: K2, K3

MODULE III	**LAPLACE TRANSFORM**	**Periods**	12 Hrs

Existence conditions-Transforms of elementary functions- Properties, Transform of unit step function and unit impulse function -Transforms of derivatives and integrals- Transforms of Periodic Functions- Initial and final value theorems. Inverse Laplace Transforms. Inverse Laplace transforms using Partial fraction methods and properties.

Teaching Learning Process	Pedagogy: Chalk and Talk, PPT, Problem solving
	RBT Level: Theory: K2, K3

MODULE IV	**FOURIER SERIES**	**Periods**	12 Hrs

Fourier Series solutions for Periodic functions and simple waveforms. Properties of Fourier Series and Dirichlet conditions.

Teaching Learning Process	Pedagogy: Chalk and Talk, PPT, Case studies, Mini projects
	RBT Level: Theory: K3, K4

MODULE V	**FOURIER TRANSFORM**	**Periods**	12 Hrs

Fourier Integral theorem (statement only), Fourier transform and its inverse – Properties, Fourier sine and cosine transform - Properties, Convolution and Parseval's identity.

Teaching Learning Process	Pedagogy: Chalk and Talk, PPT, Case studies, Mini projects
	RBT Level: Theory: K3, K4

Total	**Periods**	**60** Hrs

Suggested Activities and Evaluation Methods:

Assessment Methodology	**Assessment Tools**	**Marks**
Test		25
Mathematical modeling assignment	Analytical solution presentation	5

Transform applications project (MATLAB/Python)	Demo and viva	5
Attendance		5
Total		**40**

Course Outcomes:

After Successful completion of this course, the student should be able to

CO1: Solve higher order differential equations
CO2: Formulate and solve various types of partial differential equations
CO3: Apply Laplace transforms and initial and final value theorems to solve engineering problems involving step, impulse and periodic functions
CO4: Apply Fourier series for periodic functions and find its components with knowledge of properties
CO5: Apply Fourier transform techniques, including Fourier integral theorem, properties of Fourier transforms, convolution, and Parseval's identity

Textbooks:

T1: Veerarajan T., "Engineering Mathematics – I and II", Tata McGraw-Hill, New Delhi, 2014 and 2015.
T2: Dr. M.K. Venkataraman, "Engineering Mathematics – Volume I and Volume II", The National Publishing Company, Chennai 2008.

References:

R1: Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2015.
R2: Ramana B.V., "Higher Engineering Mathematics", Tata McGraw-Hill, New Delhi, 2010.
R3: Bali N.P and Manish Goyal., "A Text Book of Engineering Mathematics", Laxmi Publications(P) Ltd, 2011.
R4: Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, New Delhi, 9th Edition, 2011.

Web links and Video Lectures (e-Resources):

1. https://nptel.ac.in/courses/111106139
2. https://nptel.ac.in/courses/111101153
3. https://nptel.ac.in/courses/111107119

CO-PO & PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	2	-	-	-	-	-	-	-	1	1
CO2	3	2	2	2	-	-	-	-	-	-	-	1	1
CO3	3	2	2	2	-	-	-	-	-	-	-	1	1
CO4	3	2	2	2	-	-	-	-	-	-	-	1	1
CO5	3	2	2	2	-	-	-	-	-	-	-	1	1
AVG	**3**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1**

1 – Low, 2 – Medium, 3 – High, '-' – No correlation

<table>
<tr><td colspan="4">UNIVERSAL HUMAN VALUES-II</td></tr>
<tr><td colspan="4">(Common to ECE)</td></tr>
<tr><td>Course Code:</td><td>25UHST22</td><td>Course Type:</td><td>HS</td></tr>
<tr><td>Teaching Periods / Week (L:T:P):</td><td>2:0:0</td><td>Credits:</td><td>2</td></tr>
<tr><td>Total Teaching Periods:</td><td>45</td><td>CAT + ESE Marks:</td><td>40 + 60</td></tr>
<tr><td>Teaching Department:</td><td colspan="3">Electronics and Communication Engineering</td></tr>
<tr><td colspan="4">Course Objectives:</td></tr>
<tr><td colspan="4">To enable students to grasp the relevance of value-based living for personal and societal well-being.
To help students identify the components of human existence and differentiate their individual needs.
To promote an understanding of key human values that foster harmonious relationships.
To develop an awareness of the symbiotic relationship between humans and nature
To encourage ethical and humanistic behavior, particularly in professional and social contexts.</td></tr>
</table>

<table>
<tr><td>MODULE I</td><td>INTRODUCTION TO VALUE EDUCATION</td><td>Periods</td><td>9 Hrs</td></tr>
<tr><td colspan="4">Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education) ; Understanding Value Education; Self-exploration as the Process for Value Education; Continuous Happiness and Prosperity – the Basic Human Aspirations; Happiness and Prosperity – Current Scenario; Method to Fulfill the Basic Human Aspirations:Exploring Natural Acceptance</td></tr>
<tr><td rowspan="2">Teaching Learning Process</td><td colspan="3">Pedagogy: Chalk and Talk, PPT, Simulations</td></tr>
<tr><td colspan="3">RBT Level: Theory: K2, K3</td></tr>
<tr><td>MODULE II</td><td>HARMONY IN THE HUMAN BEING</td><td>Periods</td><td>9 Hrs</td></tr>
<tr><td colspan="4">Understanding Human being as the Co-existence of the Self and the Body; Distinguishing between the Needs of the Self and the Body; Exploring the difference of Needs of Self and Body; The Body as an Instrument of the Self; Understanding Harmony in the Self ; Harmony of the Self with the Body ; Programme to ensure self-regulation and Health; Exploring Harmony of Self with the Body</td></tr>
<tr><td rowspan="2">Teaching Learning Process</td><td colspan="3">Pedagogy: Chalk and Talk, PPT, Problem solving</td></tr>
<tr><td colspan="3">RBT Level: Theory: K2, K3</td></tr>
<tr><td>MODULE III</td><td>HARMONY IN THE FAMILY AND SOCIETY</td><td>Periods</td><td>9 Hrs</td></tr>
<tr><td colspan="4">Harmony in the Family – the Basic Unit of Human Interaction; „Trust' – the Foundational Value in Relationship; 'Respect' – as the Right Evaluation; Other Feelings, Justice in Human- to-Human Relationship; Understanding Harmony in the Society; Vision for the
Universal Human Order.</td></tr>
<tr><td rowspan="2">Teaching Learning Process</td><td colspan="3">Pedagogy: Chalk and Talk, PPT, Problem solving</td></tr>
<tr><td colspan="3">RBT Level: Theory: K2, K3</td></tr>
<tr><td>MODULE IV</td><td>HARMONY IN THE NATURE/EXISTENCE</td><td>Periods</td><td>9 Hrs</td></tr>
<tr><td colspan="4">Understanding Harmony in the Nature; Interconnectedness, self-regulation and Mutual Fulfillment among the Four Orders of Nature: - Exploring the Four Orders of Nature; Realizing Existence as Co-existence at All Levels; The Holistic Perception of Harmony in Existence: - Exploring Co-existence in Existence</td></tr>
<tr><td rowspan="2">Teaching Learning Process</td><td colspan="3">Pedagogy: Chalk and Talk, PPT, MATLAB demonstrations</td></tr>
<tr><td colspan="3">RBT Level: Theory: K2, K3</td></tr>
<tr><td>MODULE V</td><td>IMPLICATIONS OF THE HOLISTIC UNDERSTANDING – A LOOK
AT PROFESSIONAL ETHICS</td><td>Periods</td><td>9 Hrs</td></tr>
<tr><td colspan="4">Natural Acceptance of Human Values; Definitiveness of (Ethical) Human Conduct: -Exploring Ethical Human Conduct; A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order; Competence in Professional Ethics:- Exploring
Humanistic Models in Education; Holistic Technologies, Production Systems and Management Models-Typical Case Studies; Strategies for Transition towards Value-based Life and Profession</td></tr>
<tr><td rowspan="2">Teaching Learning Process</td><td colspan="3">Pedagogy: Chalk and Talk, PPT, Problem solving, Case studies</td></tr>
<tr><td colspan="3">RBT Level: Theory: K2, K3, K4</td></tr>
<tr><td colspan="2">Total</td><td>Periods</td><td>45 Hrs</td></tr>
<tr><td colspan="4">Suggested Activities and Evaluation Methods:</td></tr>
</table>

Assessment Methodology	**Assessment Tools**	**Marks**
Test		25
Case study analysis	Group discussion and report	5

Value-based project proposal	Presentation and peer evaluation	5
Attendance		5
Total		**40**

Course Outcomes:

After the successful completion of this course, the student should be able to

CO1: Understand the importance of value education in achieving happiness, prosperity, and holistic human development
CO2: Distinguish between the needs of the self and the body to ensure inner harmony and well-being.
CO3:Illustrate trust, respect and justice in the family and society build harmony in human relationships.
CO4: Recognize the interconnectedness and mutual fulfillment among all orders of nature to live in harmony with existence.
CO5: Describe the importance of ethical conduct based on natural acceptance of human values

Textbooks:

1. R R Gaur, R Asthana, G P Bagaria, "A Foundation Course in Human Values and Professional Ethic", Excel Books, 2nd Revised Edition, New Delhi, 2019.
2. RR Gaur, R Asthana, G P Bagaria, "Teachers‟ Manual for A Foundation Course in Human Values and Professional Ethics", Excel Books, 2nd Revised Edition New Delhi, 2019

References:

1. Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak," Jeevan Vidya" 1999.
2. A.N. Tripathi, "Human Values" New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. Mohandas Karamchand Gandhi "The Story of My Experiments with Truth"

Web links and Video Lectures (e-Resources):

1.https://nptel.ac.in/courses/109/104/109104115/
2. https://www.ugc.ac.in/pdfnews/8504234_Value-Education.pdf
3. https://www.aicte-india.org/sites/default/files/UHV%20Model%20Curriculum.pdf
4. http://www.rguktn.ac.in/value-education

CO-PO & PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1						3		3					
CO2						3	3	3			3		
CO3						3		3	3				
CO4						3	3	3		3			
CO5											3		
AVG						**2.4**	**1.2**	**2.4**	**0.6**	**0.6**	**1.2**		

1 – Low, 2 – Medium, 3 – High, '-' – No correlation

FUNDAMENTALS OF ELECTRICAL MACHINES				
(Common to ECE)				
Course Code:	25UECT23	**Course Type:**	ES	
Teaching Periods / Week (L:T:P):	3:0:0	**Credits:**	3	
Total Teaching Periods:	45	**CAT + ESE Marks:**	40 + 60	
Teaching Department:	Electronics and Communication Engineering			
Course Objectives:				
To introduce the principles of operations of DC machines as motor and generator To introduce the principles of operations of Transformers To introduce the principles of operations of Induction machines To introduce the principles of operations of Synchronous machines To introduce other special machines				
MODULE I	**D.C. MACHINES**		**Periods**	9 Hrs
D.C. Machines – Principle of operation and construction of motor and generator – torque and EMF equation – Various excitation schemes – Characteristics of Motor and Generator – Starting, Speed control and braking of D.C. Motor				
Teaching Learning Process	Pedagogy: Chalk and Talk, PPT, Circuit simulations			
	RBT Level: Theory: K2, K3			
MODULE II	**TRANSFORMERS**		**Periods**	9 Hrs
Principle, Construction and Types of Transformers - EMF equation - Equivalent circuits – Phasor diagrams - Regulation and efficiency of a transformer-three phase transformer Connection				
Teaching Learning Process	Pedagogy: Chalk and Talk, PPT, Design exercises			
	RBT Level: Theory: K2, K3, K4			
MODULE III	**SYNCHRONOUS MACHINES**		**Periods**	9 Hrs
Principle of Operation, type - EMF Equation and Phasor diagrams - Synchronous motor-RotatingMagnetic field Starting Methods, Torque V-Curves, inverted – V curves				
Teaching Learning Process	Pedagogy: Chalk and Talk, Lab demonstrations, Coding exercises			
	RBT Level: Theory: K2, K3			
MODULE IV	**THREE PHASE INDUCTION MOTORS**		**Periods**	9 Hrs
Induction motor-principle of operation, Types - Torque-slip characteristics - Starting methods and Speed control of induction motors				
Teaching Learning Process	Pedagogy: Chalk and Talk, PPT, Design projects			
	RBT Level: Theory: K3, K4			
MODULE V	**SINGLE PHASE INDUCTION MOTORS AND SPECIAL MACHINES**		**Periods**	9 Hrs
Types of single-phase induction motors –Double field revolving theory- Capacitor start capacitor run motors – Shaded pole motor – Repulsion type motor – Universal motor – Hysteresis motor -Permanent magnet synchronous motor – Switched reluctance motor – Brushless D.C motor				
Teaching Learning Process	Pedagogy: Chalk and Talk, PPT, FPGA demonstrations			
	RBT Level: Theory: K2, K3, K4			
Total			**Periods**	**45** Hrs
Suggested Activities and Evaluation Methods:				

Assessment Methodology	**Assessment Tools**	**Marks**
Test		25
Machine design calculations	Problem-solving assignment	5
Simulation analysis (ANSYS Maxwell/MATLAB/Virtual lab)	Demo and report	5
Attendance		5
Total		**40**

Course Outcomes:

After Successful completion of this course, the student should be able to

CO1: Analyze the principle of operation, construction, and characteristics of DC motors and generators, and apply methods for starting, speed control, and braking

CO2: Apply transformer principles, construct equivalent circuits,calculate efficiency and regulation, and analyze three-

phase
transformer connections.
CO3: Apply synchronous machine operation, derive EMF equations,analyze phasor diagrams, and evaluate motor starting methods
and V-curve characteristics.
CO4: Analyze induction motor principles, interpret torque-slip characteristics, and design starting methods and speed control
techniques
CO5: Analyze single-phase motors, special machines, and modern motor technologies including their operating principles and
applications.

Textbooks:

1. B.S.Guru and H.R. Hiziroglu, "Electric Machinery and Transformer, Oxford university Press 2007.
2. M.N. Bandyopadhyay, Electrical Machines Theory and Practice, PHI Learning PVT LTD., New Delhi, 2009.
3. Deshpande M. V., "Electrical Machines" PHI Learning Pvt. Ltd., New Delhi, 2011.

References:

1. Del Toro, V., "Electrical Engineering Fundamentals", Prentice Hall of India, New Delhi,1995.
2. Fitzgerald A.E, Kingsley C., Umans, S. and Umans S.D., "Electric Machinery",McGraw- Hill, Singapore, 2000.
3. Nagrath I. J and Kothari D. P. „Electric Machines, Fourth Edition, Tata McGraw Hill Publishing Company Ltd, 2010.
4. M.S. Sarma and M.K. Pathak, "Electric Machines", Cengage Learning, 2012.
5. C.A. Gross, "Electric Machines", CRC Press 2010

Web links and Video Lectures (e-Resources):

1. MIT Open Course Ware - Electric Machines URL:https://ocw.mit.edu/courses/6-685-electric-machines-fall-2013/
2. NPTEL (National Programme on Technology Enhanced Learning) URL:https://nptel.ac.in/courses/108/105/108105046/

CO-PO & PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1	1		1						1		
CO2	2	1	1		1						1		
CO3	2	1	1		1						1		
CO4	2	1	1		1						1		
CO5	2	1	1		1						1		
AVG	**2**	**1**	**1**		**1**						**1**		

1 – Low, 2 – Medium, 3 – High, '-' – No correlation

ELECTRIC AND MAGNETIC CIRCUITS

(Common to ECE)

Course Code:	25UECT24	**Course Type:**	PC
Teaching Periods / Week (L:T:P):	2:1:0	**Credits:**	3
Total Teaching Periods:	45	**CAT + ESE Marks:**	40 + 60
Teaching Department:	Electronics and Communication Engineering		

Course Objectives:

To understand the fundamental concepts of electric and magnetic circuits, analyze DC and AC circuits using various methods and theorems, and explore the behavior of magnetic and coupled circuits including transformers

MODULE I	**BASIC CONCEPTS OF ELECTRIC CIRCUITS**	**Periods**	9 Hrs

Ohm's Law, Kirchhoff's Laws (KVL and KCL), Series and Parallel Circuits, Node and Mesh Analysis, Source Transformation, Superposition Theorem, Thevenin's and Norton's Theorems, Maximum Power Transfer Theorem, Star-Delta and Delta-Star Transformation

Teaching Learning Process	Pedagogy: Chalk and Talk, PPT, Circuit simulations
	RBT Level: Theory: K2, K3

MODULE II	**ALTERNATING CURRENT (AC) CIRCUITS**	**Periods**	9 Hrs

Sinusoidal Waveforms and Phasor Representation, Impedance and Admittance Concepts, AC Circuit Analysis (RLC in series and parallel), Power in AC Circuits: Real, Reactive,Apparent Power and Power Factor, Resonance in Series and Parallel Circuits, Quality Factor and Bandwidth

Teaching Learning Process	Pedagogy: Chalk and Talk, PPT, Problem solving
	RBT Level: Theory: K2, K3

MODULE III	**TRANSIENT ANALYSIS AND THREE-PHASE CIRCUITS**	**Periods**	9 Hrs

Transient Response of RL, RC, and RLC Circuits using Laplace Transform, Initial and Final Value Theorems, Three-Phase Systems: Star and Delta Connections, Line and Phase Quantities, Power Measurement in Three-Phase Circuits (Two Wattmeter Method)

Teaching Learning Process	Pedagogy: Chalk and Talk, PPT, Design exercises
	RBT Level: Theory: K2, K3, K4

MODULE IV	**MAGNETIC CIRCUITS AND ELECTROMAGNETIC INDUCTION**	**Periods**	9 Hrs

Magnetic Field Concepts: MMF, Flux, Reluctance, Permeability, Comparison of Electric and Magnetic Circuits, Series and Parallel Magnetic Circuits, Hysteresis and Eddy Current Losses, Faraday's Laws, Lenz's Law, Self and Mutual Inductance, Coefficient of Coupling

Teaching Learning Process	Pedagogy: Chalk and Talk, PPT, Circuit simulations
	RBT Level: Theory: K2, K3

MODULE V	**COUPLED CIRCUITS AND TRANSFORMERS**	**Periods**	9 Hrs

Dot Convention and Polarity in Coupled Circuits, Equivalent Circuits and Analysis of Coupled Coils, Energy Stored in Magnetic Fields, Basics of Transformers: Ideal and Practical Transformer, Equivalent Circuit, Phasor Diagram, Losses, Efficiency, Auto
Transformers and Applications

Teaching Learning Process	Pedagogy: Chalk and Talk, PPT, Design problems
	RBT Level: Theory: K2, K3, K4

Total	**Periods**	**45** Hrs

Suggested Activities and Evaluation Methods:

Assessment Methodology	**Assessment Tools**	**Marks**
Test		25
Circuit analysis problems	Weekly problem sets	5
Troubling Exercise	Competition	5
Attendance		5
Total		**40**

Course Outcomes:

After Successful completion of this course, the student should be able to

CO1: Apply circuit laws and theorems to analyze DC circuits.

CO2: Analyze steady-state sinusoidal AC circuits using phasor Techniques
CO3: Examine the transient behavior of electrical circuits and three-phase power systems
CO4: Understand the principles of magnetic circuits and electromagnetic induction
CO5: Analyze coupled circuits and transformer operation using equivalent circuit models.

Textbooks:

1. Alexander, Charles K., and Matthew N. O. Sadiku. Fundamentals of Electric Circuits. 7th ed. New York: McGraw-Hill Education, 2021.
2. Nilsson, James W., and Susan A. Riedel. Electric Circuits. 11th ed. Boston: Pearson, 2019.
3. Hayt, William H., Jack E. Kemmerly, and Steven M. Durbin. Engineering Circuit Analysis. 9th ed. New York: McGraw-Hill Education, 2019

References:

1. Dorf, Richard C., and James A. Svoboda. Introduction to Electric Circuits. 9th ed. Hoboken: John Wiley & Sons, 2014.
2. Boylestad, Robert L. Introductory Circuit Analysis. 13th ed. Boston: Pearson, 2016.
3. Thomas, Roland E., Albert J. Rosa, and Gregory J. Toussaint. The Analysis and Design of Linear Circuits. 8th ed. Hoboken: John Wiley & Sons, 2016.
4. Irwin, J. David, and R. Mark Nelms. Basic Engineering Circuit Analysis. 11th ed. Hoboken: John Wiley & Sons, 2015

Web links and Video Lectures (e-Resources):

1. CircuitLab - Online Circuit Simulator, https://www.circuitlab.com/Interactive circuit simulation for DC, AC, and transient analysis
2. MIT OpenCourseWare - Circuits and Electronics, https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-002-circuits-and-electronics-spring-2007/Comprehensive lecture notes and problem sets on circuit fundamentals

CO-PO & PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2			1			1	1				1
CO2	3	3			1			1	1				1
CO3	3	2			1			1	1				1
CO4	3	2			1			1	1				1
CO5	3	2			1			1	1				1
AVG	3	2			1			1	1				1

1 – Low, 2 – Medium, 3 – High, '-' – No correlation

<table>
<tr><td colspan="6">PROGRAMMING IN C</td></tr>
<tr><td colspan="6">(Common to ECE)</td></tr>
<tr><td colspan="2">Course Code:</td><td>25UCSI26</td><td>Course Type:</td><td colspan="2">es</td></tr>
<tr><td colspan="2">Teaching Periods / Week (L:T:P):</td><td>2:0:2</td><td>Credits:</td><td colspan="2">3</td></tr>
<tr><td colspan="2">Total Teaching Periods:</td><td>18</td><td>CAT + ESE Marks:</td><td colspan="2">40 + 60</td></tr>
<tr><td colspan="2">Teaching Department:</td><td colspan="4">Electronics and Communication Engineering</td></tr>
<tr><td colspan="6">Course Objectives:</td></tr>
<tr><td colspan="6">To impart comprehensive knowledge of C programming through an integrated approach combining theoretical foundations with hands-on practical implementation, covering basic programming constructs, arrays, strings, functions, structures, pointers, and file handling.</td></tr>
<tr><td>MODULE I</td><td colspan="3">INTRODUCTION TO PROGRAMMING PARADIGMS</td><td>Periods</td><td>3</td></tr>
<tr><td colspan="6">ntroduction to programming paradigms – Applications of C Language – Structure of C program – C programming: Data Types – Constants – Enumeration Constants – Keywords – Operators: Precedence and Associativity – Expressions – Input/Output statements, Assignment statements – Decision making statements – Switch statement – Looping statements – Preprocessor directives – Compilation process.
Laboratory (6 hours):
Study of compilation and execution of simple C programs
Simple computational problems using arithmetic expressions
Arithmetic operations
Area and circumference of a circle
Temperature conversions</td></tr>
<tr><td colspan="2" rowspan="2">Teaching Learning Process</td><td colspan="4">Pedagogy: Chalk and Talk, PPT, Case studies</td></tr>
<tr><td colspan="4">RBT Level: K2</td></tr>
<tr><td>MODULE II</td><td colspan="3">DECISION MAKING, ARRAYS AND STRINGS</td><td>Periods</td><td>3</td></tr>
<tr><td colspan="6">Introduction to Arrays: Declaration, Initialization – One dimensional array –Two dimensional arrays – String operations: length, compare, concatenate, copy – Selection sort, linear and binary search.
Laboratory (6 hours):
Problems involving if-then-else structures
ODD/EVEN number identification
Finding greatest among numbers
Iterative problems and loop implementations
Sum of series, factorial calculation
Sum of digits, pattern printing
Array operations and string manipulation
Matrix operations (addition, subtraction)
String handling functions and palindrome checking</td></tr>
<tr><td colspan="2" rowspan="2">Teaching Learning Process</td><td colspan="4">Pedagogy: Chalk and Talk, PPT</td></tr>
<tr><td colspan="4">RBT Level: K2, K3</td></tr>
<tr><td>MODULE III</td><td colspan="3">FUNCTIONS AND POINTERS</td><td>Periods</td><td>3</td></tr>
<tr><td colspan="6">Modular programming – Function prototype, function definition, function call, Built-in functions (string functions, math functions) – Recursion, Binary Search using recursive functions – Pointers – Pointer operators – Pointer arithmetic – Arrays and pointers – Array of pointers – Parameter passing: Pass by value, Pass by reference.
Laboratory (6 hours):
Simple function implementations
nCr calculation
Swapping using call-by-value and call-by-reference
Recursive function programming
Factorial using recursion
Binary search implementation
Pointer operations
Pointers to arrays and strings
Array of pointers implementation</td></tr>
<tr><td colspan="2" rowspan="2">Teaching Learning Process</td><td colspan="4">Pedagogy: Chalk and Talk, PPT</td></tr>
<tr><td colspan="4">RBT Level: K2, K3</td></tr>
<tr><td>MODULE IV</td><td colspan="3">STRUCTURES AND UNION</td><td>Periods</td><td>3</td></tr>
<tr><td colspan="6">Structure – Nested structures – Pointer and Structures – Array of structures – Self-referential structures –</td></tr>
</table>

Dynamic memory allocation – Singly linked list – typedef – Union – Storage classes and Visibility.
Laboratory (6 hours):
Structure implementations
Student record management
Nested structures for complex data
Dynamic memory allocation
malloc, calloc, realloc implementations
Simple linked list operations

Teaching Learning Process	Pedagogy: Chalk and Talk, PPT
	RBT Level: K2, K3

MODULE V	**FILE MANAGEMENT AND MEMORY ALLOCATION**	**Periods**	3

Files- Types of file processing, I/O Operations of File, Random access file, Command line arguments.Dynamic memory allocation- Linked list, types, Preprocessor directive, Macro substitution, Compiler control directive.
Laboratory (6 hours):
File operations
Reading and writing text files
Binary file operations
Random access implementations
Comprehensive programming exercises
Mini-project combining multiple concepts

Teaching Learning Process	Pedagogy: Chalk and Talk, PPT, Project-based learning
	RBT Level: K2, K3, K4

Total	**Periods**	36

Suggested Activities and Evaluation Methods:

Assessment Methodology	**Assessment Tools**	**Marks**
Theory Test		15
Coding assignments	Online submission	10
Mini project implementation	Code demo and documentation	10
Model Practical		10
Attendance		5
Total		50

Course Outcomes:

After Successful completion of this course, the student should be able to

CO1: Apply Basic syntax of C Programming and develop simple program in C using basic constructs
CO2: Apply arrays and string operations to solve computational problems
CO3: Develop modular programs using functions, recursion, and pointers
CO4: Implement user-defined data types using structures and unions with dynamic memory management
CO5: Implement file operations and utilize preprocessor directives effectively

Textbooks:

1. ReemaThareja, “Programming in C”, Oxford University Press, Second Edition, 2016.
2. E. Balagurusamy, “Programming in C” McGraw-Hill, 8th Edition, 2019.
Kernighan, B.W and Ritchie,D.M, “The C Programming language”, Second Edition, Pearson Education, 2015

References:

1.Paul Deitel and Harvey Deitel, “C How to Program with an Introduction to C++”, 8 th edition,Pearson Education, 2018.
2. Yashwant Kanetkar, Let us C, 17th Edition, BPB Publications, 2020.
3.Pradip Dey, Manas Ghosh, “Computer Fundamentals and Programming in C”, 2 nd Edition, Oxford University Press, 2013.
4. Anita Goel and Ajay Mittal, “Computer Fundamentals and Programming in C”, 1st Edition, Pearson Education, 2013

Web links and Video Lectures (e-Resources):

1. C for Everyone: Programming Fundamentals- https://www.coursera.org/learn/c-for-everyone
2. Art of C programming -https://onlinecourses.swayam2.ac.in/cec24_cs05/preview
3. Introduction to Programming in C.- https://onlinecourses.nptel.ac.in/noc22_cs40/preview

CO-PO & PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2		2						1		
CO2	3	2	3		2						1		
CO3	3	2	3		2						1		
CO4	3	2	3		3						1		
CO5	3	2	3		3						1		
AVG	3	2	2.8		2.4						1		
1 – Low, 2 – Medium, 3 – High, '-' – No correlation													

<table>
<tr><td colspan="5">DIGITAL ELECTRONICS</td></tr>
<tr><td colspan="5">(Common to ECE)</td></tr>
<tr><td colspan="2">Course Code:</td><td>25UPCI26</td><td>Course Type:</td><td>PC</td></tr>
<tr><td colspan="2">Teaching Periods / Week (L:T:P):</td><td>3 : 0 : 2</td><td>Credits:</td><td>4</td></tr>
<tr><td colspan="2">Total Teaching Periods:</td><td>Theory: 45 + Practical: 30 = 75</td><td>CAT + ESE Marks:</td><td>50 + 50 = 100</td></tr>
<tr><td colspan="2">Teaching Department:</td><td colspan="3">Electronics and Communication Engineering</td></tr>
<tr><td colspan="5">Course Objectives:</td></tr>
<tr><td colspan="5">To impart fundamental knowledge of digital electronics including number systems, Boolean algebra, and logic gates, establishing a strong theoretical foundation for digital circuit design.
To develop analytical and design skills for creating combinational and sequential logic circuits using systematic design procedures and minimization techniques.
To enable students to implement and test digital circuits through hands-on laboratory experiments using standard ICs and modern simulation tools.
To prepare students for advanced courses in microprocessors, computer architecture,and embedded systems by providing essential digital logic concepts and practical skills</td></tr>
<tr><td>MODULE I</td><td colspan="2">NUMBER SYSTEMS AND DIGITAL CODES</td><td colspan="2">Periods: 9+6</td></tr>
<tr><td colspan="5">Binary, octal, decimal and hexadecimal number systems, number system conversions, binary arithmetic operations, 1's complement and 2's complement representation, signed and unsigned numbers, BCD code, Gray code, ASCII code, Excess-3 code, error detection using parity bit, digital signal characteristics</td></tr>
<tr><td colspan="2" rowspan="2">Teaching Learning Process</td><td colspan="3">Pedagogy: Chalk and Talk, PowerPoint Presentations, Live Coding Demonstrations, Hands-on Lab Sessions, Problem-Based Learning</td></tr>
<tr><td colspan="3">RBT Level: Theory: K1, K2 | Practical: K3</td></tr>
<tr><td>MODULE II</td><td colspan="2">BOOLEAN ALGEBRA AND LOGIC GATES</td><td colspan="2">Periods: 9+6</td></tr>
<tr><td colspan="5">Basic logic gates (AND, OR, NOT), universal gates (NAND, NOR), exclusive gates (XOR, XNOR), truth tables and timing diagrams, Boolean postulates and theorems, De Morgan's theorems, simplification of Boolean expressions, standard forms (SOP and POS), canonical forms (minterms and maxterms), duality principle</td></tr>
<tr><td colspan="2" rowspan="2">Teaching Learning Process</td><td colspan="3">Pedagogy: Interactive Lectures, Code Walkthroughs, Peer Programming, Debugging Exercises, Mini Projects</td></tr>
<tr><td colspan="3">RBT Level: Theory: K2, K3 | Practical: K3, K4</td></tr>
<tr><td>MODULE III</td><td colspan="2">MINIMIZATION TECHNIQUES</td><td colspan="2">Periods: 9+6</td></tr>
<tr><td colspan="5">Karnaugh maps for 2, 3 and 4 variables, don't care conditions, Quine-McCluskey method</td></tr>
<tr><td colspan="2" rowspan="2">Teaching Learning Process</td><td colspan="3">Pedagogy: Demonstrations, Collaborative Learning, Case Studies on Real ECE Data, Hands-on Exercises</td></tr>
<tr><td colspan="3">RBT Level: Theory: K2, K3 | Practical: K3, K4</td></tr>
<tr><td>MODULE IV</td><td colspan="2">COMBINATIONAL CIRCUITS</td><td colspan="2">Periods: 9+6</td></tr>
<tr><td colspan="5">Implementation using NAND and NOR gates, half adder, full adder, half subtractor, full subtractor, parallel binary adder. Multiplexers (2:1, 4:1, 8:1), demultiplexers, encoders and decoders (2×4, 3×8), BCD to 7-segment decoder</td></tr>
<tr><td colspan="2" rowspan="2">Teaching Learning Process</td><td colspan="3">Pedagogy: Project-Based Learning, Live Demonstrations, Code Review Sessions, Industry Case Studies</td></tr>
<tr><td colspan="3">RBT Level: Theory: K2, K3 | Practical: K4, K5</td></tr>
<tr><td>MODULE V</td><td colspan="2">SEQUENTIAL LOGIC CIRCUITS</td><td colspan="2">Periods: 9+6</td></tr>
<tr><td colspan="5">Difference between combinational and sequential circuits, SR latch using NAND and NOR gates, gated SR</td></tr>
</table>

latch, D flip-flop, JK flip-flop, T flip-flop, master-slave configuration		
Teaching Learning Process	Pedagogy: Hands-on Lab Sessions, Real-world Problem Solving, Mini-Project Development, Peer Review	
	RBT Level: Theory: K3, K4 | Practical: K4, K5	
Total		**Theory: 45 + Practical: 30 = 75 Periods**

List of Experiments:
Experiment 1: Verification of Logic Gates
To verify the truth tables of basic logic gates (AND, OR, NOT), universal gates (NAND, NOR), and exclusive gates (XOR, XNOR) using 7400 series ICs.
Experiment 2: Boolean Theorem Verification
To implement and verify De Morgan's theorems and other Boolean identities using logic gate ICs.
Experiment 3: Half Adder and Full Adder
To design and implement half adder and full adder circuits and verify their sum and carry outputs.
Experiment 4: Half Subtractor and Full Subtractor
To design and implement half subtractor and full subtractor circuits and demonstrate binary subtraction with borrow.
Experiment 5: 4-bit Binary Adder
To implement a 4-bit parallel adder using IC 7483 and demonstrate ripple carry propagation in multi-bit addition.
Experiment 6: Multiplexer Applications
To study 8:1 multiplexer (IC 74151) operation and implement Boolean functions using multiplexer as a universal logic element.
Experiment 7: Decoder and Encoder Circuits
To implement 3×8 decoder (IC 74138) and priority encoder (IC 74147) circuits and demonstrate their applications in digital systems.
Experiment 8: Code Converters
Objective: To design and implement Binary to Gray, Gray to Binary, and BCD to Excess-3 code converters using logic gates.
Experiment 9: Latches and Flip-Flops
Objective: To construct SR latch and verify the operation of D and JK flip-flops with emphasis on edge-triggering and timing characteristics

Suggested Assessment Methods

Assessment Methodology	**Assessment Tools**	**Marks**
Theory Test		15
Logic design project	Hardware implementation	10
Digital system simulation (Quartus/Vivado)	Demo and viva	10
Model Practical		10
Attendance		5
Total		50

Course Outcomes:

After successful completion of this course, the student should be able to:

CO1: Convert between number systems and apply binary arithmetic operations with practical verification
CO2: Analyze and simplify Boolean expressions using Boolean algebra theorems and Karnaugh maps
CO3: Design and build combinational logic circuits for real-world applications
CO4: Construct and test sequential circuits including flip-flops and Counters
CO5: Troubleshoot and debug digital circuits using test equipment and simulation tools

Textbooks:

1. M. Morris Mano and Michael D. Ciletti, "Digital Design", Pearson Education, 6th Edition, 2018.
2. R.P. Jain, "Modern Digital Electronics", McGraw Hill Education, 4th Edition, 2017.

References:

1. Thomas L. Floyd, "Digital Fundamentals", Pearson Education, 11th Edition, 2015.
2. Anil K. Maini, "Digital Electronics: Principles and Integrated Circuits", Wiley India, 2017.
3. S. Salivahanan and S. Arivazhagan, "Digital Circuits and Design", Oxford University Press, 5th Edition, 2018

Web Links and Video Lectures (e-Resources):

1. NPTEL Course - Digital Circuits and Systems: https://nptel.ac.in/courses/108/105/108105134/
2. CircuitVerse - Digital Circuit Simulator: https://circuitverse.org/
3. Falstad Circuit Simulator: https://www.falstad.com/circuit/

CO-PO & PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PO 9	PO1 0	PO11	PSO1	PSO2
CO1	3	3			2					1	1	1	
CO2	3	3			2					1	1	1	
CO3	3	3			2					1	1	1	
CO4	3	3			2					1	1	1	
CO5	3	2			2					1	1	1	
AVG	3	2.8			2					1	1	1	

1 – Low, 2 – Medium, 3 – High, '-' – No correlation

Electric Circuits and Machines Laboratory

(Common to ECE)

Course Code:	25UECP21	**Course Type:**	ES
Teaching Periods / Week (L:T:P):	0:0:2	**Credits:**	1
Total Teaching Periods:	30	**IAT + ESE Marks:**	60 + 40
Teaching Department:	Electronics and Communication Engineering		

Course Objectives:

This laboratory course provides practical experience in electrical machines, circuit analysis, and basic electronics applications.

The objectives are to:

Understand operation and characteristics of electrical machines

Gain hands-on experience with AC/DC circuit analysis

Learn measurement techniques for electrical parameters

Develop skills in motor control and protection systems

Apply safety practices in electrical laboratory environment

Practical Exercises:	**Periods (9+6 hrs)**

Experiment 1: Power Factor Improvement To measure power factor in AC circuits and demonstrate improvement using capacitor compensation with before-and-after analysis.

Experiment 2: Single-Phase Transformer Testing : To perform open circuit and short circuit tests on single-phase transformer to determine equivalent circuit parameters, efficiency, and regulation.

Experiment 3: Transformer Load Test : To analyse transformer performance under various loading conditions and plot voltage regulation, losses, and efficiency curves.

Experiment 4: Three-Phase Transformer Connections To study star-star and delta-delta connectionsof three-phase transformers, identify vector groups, and analyze load sharing in parallel operation.

Experiment 5: DC Generator Characteristics To determine and plot the external and internal characteristics of separately excited, shunt, and series DC generators including voltage build-up process.

Experiment 6: DC Motor Characteristics : To obtain speed-torque characteristics of DC shunt and series motors and demonstrate various speed control methods.

Experiment 7: DC Motor Starting and Control : To study three-point and four-point starters for DC motors and perform brake test to determine efficiency with field and armature speed control methods.

Experiment 8: Three-Phase Induction Motor: To conduct no-load and blocked rotor tests on three-phase induction motor to determine equivalent circuit parameters, slip-torque characteristics, and efficiency.

Experiment 9: Single-Phase Induction Motor: To study starting methods and obtain speed-torque characteristics of capacitor-start single-phase induction motor with performance comparison.

References:

1. A.E. Fitzgerald, Charles Kingsley Jr., and Stephen D. Umans, "Electric Machinery", McGraw-Hill, 7th Edition, 2013.
2. B.S. Guru and H.R. Hiziroglu, "Electric Machinery and Transformers", Oxford University Press, 3rd Edition, 2000.
3. James W. Nilsson and Susan A. Riedel, "Electric Circuits", Pearson, 11th Edition, 2019.
4. P.S. Bimbhra, "Electrical Machinery", Khanna Publishers, 7th Edition, 2011.

ONLINE/NPTEL COURSES

1. NPTEL Electrical Machines Laboratory - https://nptel.ac.in/courses/108/105/108105053/
2. Virtual Labs - Electrical Machines Lab - http://vlabs.iitb.ac.in/vlabs-dev/labs/eerc03/
3. MIT OpenCourseWare - Circuits and Electronics - https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/

Assessment Methodology	**Assessment Tools**	**Marks**
Laboratory Conduction	Observation	10
Record work		10
Model exam		15
Viva		5
Virtual lab assignment	Review	10
Attendance		10
Total		60

Course Outcomes:

After Successful completion of this course, the student should be able to

CO1. Measure and analyze power factor in AC circuits and implement capacitive compensation techniques for power quality improvement

CO2. Conduct standard tests on single-phase and three-phase transformers to determine equivalent circuit parameters, efficiency, and regulation

CO3. Evaluate performance characteristics of DC generators and motors including speed control and starting methods

CO4. Analyze the operational characteristics of single-phase and three-phase induction motors through performance testing

CO5. Compare and assess different machine configurations and control methods for optimal performance in electrical systems

CO–PO & PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1								1	1	
CO2	3	3	2								2	1	
CO3	3	3	2								2	1	
CO4	3	3	2								3	1	
CO5	3	3	2								3	1	
AVG	3	2.8	1.8								2.2	1	

1–Low, 2–Medium, 3–High, '-' –No correlation

ELECTRONICS FABRICATION LAB (LAB Course)			
(Common to ECE)			
Course Code:	25UECP22	**Course Type:**	ES
Teaching Periods / Week (L:T:P):	0:0:2	**Credits:**	1
Total Teaching Periods:	30	**IAT + ESE Marks:**	60 + 40
Teaching Department:	Electronics and Communication Engineering		

Course Objectives:

To provide hands-on experience in designing printed circuit boards from schematic capture to layout generation using industry-standard EDA tools, enabling students to create professional-quality electronic circuit designs.
To train students in multiple PCB manufacturing methods including photolithographic chemical etching and CNC milling, fostering understanding of fabrication constraints and design for manufacturability principles.
To develop professional-level soldering skills for both through-hole and surface mount components, ensuring students can reliably assemble and rework modern electronic circuits.
To equip students with 3D printing skills for creating custom enclosures, fixtures, and mechanical components essential for complete electronic product development.
To cultivate the ability to combine multiple fabrication techniques for creating functional electronic prototypes, emphasizing quality control, testing, and troubleshooting methodologies

Practical Exercises:	**Periods (9+6 hrs)**

Experiment 1: Introduction to PCB Design Software
To familiarize with EDA tools and create simple schematic diagrams using KiCad/Eagle for basic electronic circuits.
Experiment 2: Schematic Capture and Component Libraries To design complete circuit schematics with proper component selection, library management, and design rule checking (DRC) for a given electronic application.
Experiment 3: PCB Layout Design To convert schematic designs into PCB layouts with proper component placement, routing, and
generation of Gerber files for manufacturing.
Experiment 4: Single-Layer PCB Fabrication - Chemical Etching To fabricate single-layer PCBs using photolithography process including photo-resist preparation, UV exposure, development, and chemical etching.
Experiment 5: Double-Layer PCB Fabrication - CNC Milling To produce double-sided PCBs using CNC milling machine with isolation routing, via drilling, and precise layer alignment techniques.
Experiment 6: Through-Hole Soldering Techniques To master through-hole component soldering skills including proper iron temperature control, flux application, and solder joint inspection for reliable connections.
Experiment 7: Surface Mount Device (SMD) Soldering To develop proficiency in SMD soldering techniques using hot air rework station, solder paste application, and reflow methods for modern electronic assembly.
Experiment 8: 3D Printing for Electronic Enclosures To design and fabricate custom electronic enclosures using FDM 3D printing technology with appropriate material selection and post-processing techniques.
Experiment 9: Advanced 3D Printing Applications To create specialized electronic components including heat sinks, cable organizers, sensor mounts, and mechanical fixtures using additive manufacturing.
Experiment 10: PCB Assembly and Testing To complete full PCB assembly combining fabricated boards with soldered components, followed by functional testing, troubleshooting, and quality verification

References:

1. David L. Jones, "PCB Design Tutorial", CreateSpace Independent Publishing, Revised Edition, 2019.
2. Charles Platt, "Encyclopedia of Electronic Components (Volume 1-3)", O'Reilly Media, 2016.
3. Ben Redwood, Filemon Schöffer, and Brian Garret, "The 3D Printing Handbook: Technologies, Design and Applications", 3D Hubs, 2017.
4. Kraig Mitzner, "Complete PCB Design Using OrCAD Capture and PCB Editor", Newnes, 2nd Edition, 2019.

Assessment Methodology	**Assessment Tools**	**Marks**
Laboratory Conduction	Observation	10
Record work		10

Model exam		15
Viva		5
PCB design and fabrication	Working prototype demo	5
3D Model contest	Review	5
Attendance		10
Total		60

Course Outcomes:

After Successful completion of this course, the student should be able to

CO 1. **Design and generate manufacturing-ready PCB layouts using professional EDA tools with proper component selection and routing techniques**

CO 2. **Fabricate single and multi-layer PCBs using chemical etching and CNC milling processes while adhering to safety protocols.**

CO 3. **Execute professional soldering techniques for through-hole and SMD components with consistent quality and reliability**

CO 4. **Design and manufacture custom electronic enclosures and mechanical fixtures using 3D printing technology**

CO 5. **Integrate multiple fabrication techniques to produce complete, tested, and functional electronic prototypes**

CO–PO & PSO Mapping

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3			3			1			2			
CO2	3	3			3			1						
CO3	3	3			3			1						
CO4	3	3			3			1			2			
CO5	3	3			3			1						
AVG	3	3			3			1			0.8			

1–Low, 2–Medium, 3–High

COMMUNICATION SKILLS			
(Common to ECE)			
Course Code:	25UPCE21	**Course Type:**	EEC
Teaching Periods / Week (L:T:P):	0 : 0 : 2	**Credits:**	0
Total Teaching Periods:	30 Hours	**IAT + ESE Marks:**	60 + 40 = 100
Teaching Department:	Department of Electronics and Communication Engineering		

Course Objectives:

To develop effective interpersonal communication skills and enhance students' ability to interact professionally in team environments and collaborative settings.

To strengthen verbal and non-verbal communication abilities through practical exercises in listening, conversation, presentation, and public speaking skills.

To improve written communication competency by developing clarity, conciseness, and audience awareness in various forms of written expression.

To build self-awareness and analytical thinking through SWOT analysis and self-assessment techniques for personal and professional development.

To foster teamwork and leadership qualities through active participation in group activities, debates, conflict resolution, and collaborative problem-solving exercises.

MODULE I	**DESIGN THINKING FUNDAMENTALS AND IDEATION**	**Periods: 14**

MODULE 1 (6 Hours)

Motivation – II: Intrinsic vs. Extrinsic Motivation - Goal Setting and Achievement - Building and Sustaining Motivation Interpersonal Skills: Effective Communication - Active Listening - Conflict Resolution

- Teamwork and Collaboration

MODULE 2 (6 Hours).

Listening Skills: Roles and Responsibilities in a Team - Building Trust and Respect Among Team Members – Effective Team Communication Conversation Skills: Starting and Maintaining a Conversation - Non-Verbal

Communication Cues - Active Listening and Responding

MODULE 3 (6 Hours)

Reading Skills: Skimming and Scanning Techniques – Critical reading and Interpretation

Writing Skills: Grammar and Syntax - Clarity and Conciseness - Audience Awareness

MODULE 4 (6 Hours)

Presentation Speaking Skills: Speech Structure and Organization – Verbal Delivery Techniques Public Speaking Skills: Confidence and overcoming Anxiety – Effective message Delivery SWOT Analysis: Identifying Internal Factors – Analyzing External Factors

MODULE 5 (6 Hours)

Team Building: Roles and Responsibilities in a team – Communication and Trust – Conflict resolution and Problem Solving Active Sessions: Debate – Picture Connector

Assessment Methodology	**Assessment Tools**	**Marks**
Test 1 (Modules 1-2)	Internal Tests	15
Test 2 (Modules 3-5)	Internal Tests	15
Presentation Skills Demonstration	Practical Assessment	15
Public Speaking and Confidence Assessment	Practical Assessment	10
SWOT Analysis Report	Assignment	10

Active Listening and Conversation Skills Demo	Practical Assessment	10
Team Building Activity and Leadership Role	Project	10
Debate Participation and Performance	Practical Assessment	10
Attendance and Class Participation	Continuous Assessment	5
		100

After successful completion of this course, the student should be able to:

CO1: Value sustained motivation and appreciate the importance of interpersonal skills for effective communication and teamwork.

CO2: Respond positively to active listening opportunities and demonstrate willingness to engage in collaborative team interactions.

CO3: Organize personal reading and writing habits to consistently practice critical analysis and audience-focused expression

CO4: Characterize personal strengths and weaknesses through SWOT analysis while demonstrating confidence in public speaking situations

CO5: Receive feedback constructively during team collaboration activities and show openness to participate in debates and group problem-solving

Textbooks / References:

1. Chakravathi, T. Kalyana. Soft Skills for Managers. New Delhi: McGraw Hill Education, 2018.
2. Mitra, Barun K. Personal Development and Soft Skills. Oxford: Oxford Higher Education, 2011

Web Links and Video Lectures (e-Resources):

1. Goleman, Daniel. The Emotionally Intelligent Workplace. New York: Bantam Books, 2001.
2. Kumar, E. Suresh, P. Sreehari, and J. Savithri. Communication Skills and Soft Skills: An Integrated Approach. Chennai: Pearson India, 2015.
3. Rajendra, Charles T. Top Talking in English (International Communication Skills).New Delhi: Sultan Chand & Sons, 2010.
4. Suryavanshi, Raj Lakshmi. Soft Skills. Pune: Gurucool Publishing, 2016

CO-PO & PSO Mapping

CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PSO 1**	**PSO 2**
CO1							2	2	2		3		
CO2							2	2	2		3		
CO3							2	2	2		3		
CO4							2	2	2		3		
CO5							2	2	2		3		
AVG							2	2	2		3		

1 – Low, 2 – Medium, 3 – High, '-' – No correlation

IKS IN HUMANITIES AND SOCIAL SCIENCE

Common to all Branches

Course Code:	25UMCC21	**Course Type:**	MCC
L : T : P:	0:0:2	**Credits:**	0 (Zero Credit)
Total Periods:	30 Hours	**Evaluation:**	Internal Assessment
Teaching Department:	Placement and Training Cell		
Prerequisite:	Basic proficiency in English communication, fundamental understanding of self-awareness		

Course Objectives:

This course explores Indian Knowledge Systems in the context of humanities and social sciences, providing students with a deeper understanding of India's intellectual heritage.

The objectives are to:

- Understand the philosophical foundations of Indian knowledge traditions
- Explore Indian contributions to social sciences, literature, and arts
- Analyze the relevance of ancient wisdom in contemporary social contexts
- Develop appreciation for cultural diversity and heritage Foster critical thinking about knowledge systems and their applications

MODULE I	**PHILOSOPHICAL FOUNDATIONS OF INDIAN KNOWLEDGE SYSTEMS**	**6 Hrs**

Darshanas (Schools of Philosophy): Samkhya, Yoga, Nyaya, Vaisheshika, Mimamsa, Vedanta - Epistemology in Indian philosophy: Pramanas (means of knowledge) - Ethics and moral philosophy in Indian traditions - Concept of Dharma, Artha, Kama, and Moksha - Comparative study with Western philosophical traditions

MODULE II	**INDIAN LITERARY AND ARTISTIC TRADITIONS**	**6 Hrs**

Sanskrit literature: Vedas, Upanishads, Puranas, Epics (Ramayana, Mahabharata) – Classical poetry and drama: Kalidasa, Bhartrhari, Bhasa - Regional literature and folk traditions - Indian classical music and dance: Theoretical foundations - Visual arts: Sculpture, painting, and architectural styles - Aesthetics in Indian tradition: Rasa theory and Alamkara shastra

MODULE III	**SOCIAL ORGANIZATION AND GOVERNANCE**	**6 Hrs**

Ancient Indian social structure and organization - Varna and Ashrama systems: Historical context and evolution - Village self-governance: Panchayati Raj origins - Arthashastra: Principles of statecraft and administration - Justice system: Dharmashastra and Rajadharma - Economic systems: Trade, agriculture, and crafts

MODULE IV	**EDUCATIONAL SYSTEMS AND KNOWLEDGE TRANSMISSION**	**6 Hrs**

Gurukula system: Teacher-student relationship - Ancient universities: Nalanda, Takshashila, Vikramshila - Oral tradition and preservation of knowledge – Women's education in ancient India - Integration of spiritual and material learning - Comparison with modern educational approaches

MODULE V	**CONTEMPORARY RELEVANCE AND APPLICATIONS**	**6 Hrs**

Indian knowledge systems in modern governance - Traditional conflict resolution mechanisms - Environmental consciousness in Indian traditions - Community-based development models - Gender studies: Women in Indian philosophical traditions - Relevance of Indian ethics in corporate governance - Cultural preservation and modernization challenges

Assessment Methodology	**Assessment Tools**	**Marks**
Philosophical Analysis Assignment	Assignment	25
Comparative Study Project (Ancient vs Modern)	Project	20

Literary/Artistic Tradition Presentation	Presentation	20
Heritage Site Visit and Report	Field Work	10
Contemporary Application Case Study	Assignment	15
Attendance and Class Participation	Continuous Assessment	10
Total		100

Course Outcomes:

After successful completion of this course, the student should be able to:
Understand the philosophical foundations and methodologies of Indian knowledge systems in humanities
Analyze Indian contributions to literature, arts, social organization, and governance systems
Apply principles from Indian philosophical traditions tocontemporary social and ethical issues
Evaluate the relevance and adaptability of traditional knowledge in modern social contexts
Create connections between ancient wisdom and contemporary challenges in society

Textbooks:

1. S. Radhakrishnan, “Indian Philosophy”, Oxford University Press, 2008
2. A.L. Basham, “The Wonder That Was India”, Rupa Publications, 2017
3. Kapila Vatsyayan, “Traditional Indian Art and Culture”, Cambridge University

References:

1. Heinrich Zimmer, “Philosophies of India”, Princeton University Press, 1989
2. Romila Thapar, “Early India: From the Origins to AD 1300”, Penguin Books, 2015
3. K.M. Munshi, “The History and Culture of the Indian People”, Bharatiya Vidya Bhavan
4. Digital Library of India: https://www.dli.gov.in
5. Sahapedia - Encyclopedia of Indian Culture: https://www.sahapedia.org
6. Indian Council of Historical Research: https://ichr.ac.in
7. Archaeological Survey of India: https://asi.nic.in

CO-PO & PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	1						2		2		3		
CO2	2						2		3		3		
CO3	2					2	3		3		3		
CO4	2					3	3		3		3		
CO5	3					3	3		3		3		
AVG	2					1.6	2.6		2.8		3		

HOLISTIC WELLNESS			
(Common to All Branches of UG Engineering Programs)			
Course Code:	25UMCC22	**Course Type:**	Mandatory (MCC)
Teaching Periods / Week (L:T:P):	0:0:1	**Credits:**	0
Total Teaching Periods:	30	**IAT + ESE Marks:**	-
Teaching Department:	General Engineering		

Course Objectives:

This course promotes physical fitness, mental well-being, and holistic development of students. The objectives are to:

- Develop physical fitness and motor skills through sports activities
- Learn yoga techniques for stress management and mental clarity
- Understand the importance of physical activity for academic performance
- Promote teamwork, leadership, and sportsmanship
- Establish lifelong habits for health and wellness

MODULE I	**INTRODUCTION TO PHYSICAL FITNESS**	**Periods: 6**

Importance of physical fitness for students - Components of fitness: strength, endurance, flexibility, coordination - Fitness assessment and goal setting - Safety guidelines and injury prevention - Warm-up and cool-down techniques

Instructional Activity

Timeline Activity on Constitutional History (or) Preamble Analysis Worksheet

Teaching Learning Process	Pedagogy: Interactive Lecture, Think-Pair-Share, Video-based Learning (Documentary on Constituent Assembly), Group Discussion
	RBT Level: Theory: K1, K2

MODULE II	**SPORTS ACTIVITIES**	**Periods: 6**

Option A: Team Sports (Choose any two) - Cricket: Basic skills, rules, and match play - Football: Fundamental techniques and game strategies - Basketball: Shooting, dribbling, and team coordination - Volleyball: Serving, spiking, and court positioning - Badminton: Strokes, footwork,and doubles play

Option B: Individual Sports (Choose any two) - Athletics: Running, jumping, and throwing events - Table Tennis: Basic strokes and match play - Tennis: Forehand, backhand, and court coverage - Swimming: Basic strokes and water safety - Cycling: Technique and endurance building

Instructional Activity

Case Study Analysis on Landmark Supreme Court Judgments (or) Mock PIL Filing Exercise (or) Rights Violation Scenario Analysis

Teaching Learning Process	Pedagogy: Case Study Method, Role Play (Mock Court), Jigsaw Activity, Debate Session (FR vs DPSP), Scenario-based Learning, Problem-Based Learning
	RBT Level: Theory: K1, K2

MODULE III	**YOGA AND MINDFULNESS**	**Periods: 6**

Introduction to yoga philosophy and benefits - Basic yoga asanas (postures): Sun salutation, standing poses, seated poses - Pranayama (breathing techniques): Deep breathing, alternate nostril breathing - Meditation and mindfulness practices - Relaxation techniques and stress managementCommission. Local Self Government: 73rd Amendment (Panchayati Raj) - 74th Amendment (Urban Local Bodies) - Three-tier System.

	PRACTICAL ACTIVITIES	**Periods: 6**

Yoga Sessions: - Daily morning yoga practice - Guided meditation sessions - Breathing exercise workshops - Stress relief techniques - Mindfulness activities.

Assessment Methodology	**Assessment Tools**	**Marks**
Sports Skills Demonstration (Team/Individual Sports)	Practical Assessment	25
Yoga Asanas and Breathing Techniques Performance	Practical Assessment	25
Personal Fitness Plan Development and Implementation	Practical Assessment	25
Physical Activity and Academic Performance Analysis	Practical Assessment	25
Total		100

Course Outcomes:

After successful completion of this course, the student should be able to:

CO1 Understand the historical background of the Indian Constitution, the role of the Constituent Assembly and Drafting Committee, the philosophy and core values of the Preamble, and the salient features of the Indian Constitution. [K2: Understand]

CO2 Describe the Fundamental Rights, Directive Principles of State Policy, and Fundamental Duties, including constitutional remedies and writs, and explain their relationship through judicial interpretations. [K2: Understand]

CO3 Understand the structure, powers, and functions of the Union, State, and Local Self Governments, including legislative processes and Centre–State relations under the Indian Constitution. [K2: Understand]

CO4 Apply the concepts and principles of human rights to identify international human rights frameworks and analyze the role of constitutional and statutory bodies in human rights protection in India. [K3: Apply]

CO5 Apply constitutional provisions, laws, and remedial mechanisms to analyze contemporary human rights issues, including those related to vulnerable groups, digital rights, environmental rights, and grievance redressal systems. [K3: Apply]

Textbooks:

1. "Complete Guide to Physical Fitness" - Physical Education Department Manual

2. B.K.S. Iyengar, "Light on Yoga", Harper Thorsons, 1991

References:

1. "Sports Training Principles" by Frank W. Dick, A&C Black, 2007

2. Swami Muktibodhananda, "Hatha Yoga Pradipika", Yoga Publications Trust,2012

Web Links and Video Lectures (e-Resources):

CO-PO & PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PSO1	PSO2
CO1								2	2		1		
CO2								2	2		2		
CO3								3	3		3		
CO4								2	2		2		
CO5								3	3		3		
AVG								2.4	2.4		2.2		

1 - Low, 2 - Medium, 3 - High

Syllabus
Semester III

LINEAR ALGEBRA FOR SCIENTIFIC COMPUTING			
(Common to ECE)			
Course Code:	25UMAT31	**Course Type:**	BS
Teaching Periods / Week (L:T:P):	3:1:0	**Credits:**	4
Total Teaching Periods:	60	**CAT + ESE Marks:**	40 + 60
Teaching Department:	Mathematics		

Course Objectives:

To understand the concepts of vector spaces and linear transformations To learn matrix decomposition techniques and their applications To apply eigenvalues and eigenvectors in engineering problems To understand inner product spaces and orthogonalization

MODULE I	**VECTOR SPACES**	**Periods**	12 Hrs

Vector spaces – Subspaces – Linear independence – Basis and dimension – Row space, Column space and Null space – Rank and Nullity theorem – Linear transformations – Kernel and Range – Matrix representation of linear transformations.

Teaching Learning Process	Pedagogy: Chalk and Talk, PPT, Problem solving
	RBT Level: Theory: K2, K3

MODULE II	**EIGENVALUES AND EIGENVECTORS**	**Periods**	12 Hrs

Characteristic equation – Eigenvalues and Eigenvectors – Properties – Cayley-Hamilton theorem – Diagonalization – Powers of a matrix – Quadratic forms – Nature of quadratic forms – Reduction to canonical form.

Teaching Learning Process	Pedagogy: Chalk and Talk, PPT, Problem solving
	RBT Level: Theory: K2, K3

MODULE III	**ORTHOGONALITY AND LEAST SQUARES**	**Periods**	12 Hrs

Inner product spaces – Orthogonal sets – Orthogonal projections – Gram-Schmidt orthogonalization process – QR factorization – Least squares problems – Least squares solutions.

Teaching Learning Process	Pedagogy: Chalk and Talk, PPT, Problem solving
	RBT Level: Theory: K2, K3

MODULE IV	**MATRIX DECOMPOSITIONS**	**Periods**	12 Hrs

LU decomposition – Cholesky decomposition – Singular Value Decomposition (SVD) – Applications of SVD – Principal Component Analysis (PCA) – Applications in data compression and image processing.

Teaching Learning Process	Pedagogy: Chalk and Talk, PPT, Case studies
	RBT Level: Theory: K2, K3

MODULE V	**APPLICATIONS OF LINEAR ALGEBRA**	**Periods**	12 Hrs

Applications in signal processing – Discrete Fourier Transform as matrix multiplication – Applications in communication systems – State space representation – Solution of system of differential equations – Applications in circuit analysis.

Teaching Learning Process	Pedagogy: Chalk and Talk, PPT, Case studies, Mini projects
	RBT Level: Theory: K3, K4

Total	**Periods**	**60** Hrs

Suggested Activities and Evaluation Methods:

Tutorials, Quiz/MCQ (GATE Related Questions),
Problem-solving sessions, Model Exam, CAT

Course Outcomes:

After Successful completion of this course, the student should be able to

CO1: Apply the concepts of vector spaces, subspaces, linear independence, basis, and linear transformations to solve engineering and scientific computing problems.
CO2: Compute eigenvalues and eigenvectors of matrices and apply them to matrix diagonalization, quadratic forms, and related engineering applications.
CO3: Apply inner product space concepts, orthogonalization techniques, and least squares methods to solve approximation and data fitting problems.
CO4: Perform matrix decomposition techniques such as LU, Cholesky, and Singular Value Decomposition (SVD) and apply them to data analysis and dimensionality reduction problems.

CO5: Analyze and model engineering systems using linear algebra concepts in signal processing, communication systems, state-space representation, and circuit analysis.

Textbooks:

T1: Gilbert Strang, "Linear Algebra and its Applications", 5th Edition, Cengage Learning, 2016

T2. David C. Lay, Steven R. Lay, Judi J. McDonald, Linear Algebra and Its Applications, 5th Edition, Pearson Education, 2016.

References:

R1: Howard Anton, Chris Rorres, 'Elementary Linear Algebra: Applications Version', 11th Edition, Wiley, 2014

R2: Stephen Boyd, Lieven Vandenberghe, "Introduction to Applied Linear Algebra", Cambridge, 2018

R3. Jim Hefferon, "Linear Algebra", 4th Edition, 2020

Web links and Video Lectures (e-Resources):

1. NPTEL: Linear Algebra - https://nptel.ac.in/courses/111106051
2. MIT OpenCourseWare – Linear Algebra (18.06) https://ocw.mit.edu/courses/mathematics/18-06-linear-algebra-spring-2010/
3. Khan Academy – Linear Algebra https://www.khanacademy.org/math/linear-algebra
4. Coursera – Mathematics for Machine Learning: Linear Algebra https://www.coursera.org/learn/linear-algebra-machine-learning

CO-PO & PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	2	2	-
CO2	3	3	2	-	-	-	-	-	-	-	2	2	-
CO3	3	2	2	-	-	-	-	-	-	-	2	2	-
CO4	3	3	2	-	2	-	-	-	-	-	2	3	2
CO5	3	3	3	-	2	-	-	-	-	-	3	3	2
AVG	3	2.6	1.8	0	0.8	0	0	0	0	0	2.2	2.4	0.8

1 – Low, 2 – Medium, 3 – High, '-' – No correlation

SIGNALS AND SYSTEMS			
(Common to ECE)			
Course Code:	25UECT32	**Course Type:**	PC
Teaching Periods / Week (L:T:P):	2:1:0	**Credits:**	3
Total Teaching Periods:	45	**CAT + ESE Marks:**	40 + 60
Teaching Department:	Electronics and Communication Engineering		

Course Objectives:

To understand the classification and representation of signals and systems
To analyze continuous-time and discrete-time signals and systems
To understand Fourier series, Fourier transform and their properties
To apply Laplace and Z-transforms for system analysis

MODULE I	**CLASSIFICATION OF SIGNALS AND SYSTEMS**	**Periods**	9 Hrs

Continuous-time and discrete-time signals – Classification of signals: periodic and aperiodic, even and odd, energy and power signals, deterministic and random signals. Systems: Classification – Linear and nonlinear, time-invariant and time-variant, causal and non-causal, stable and unstable systems – Impulse response – Convolution integral and sum.

Teaching Learning Process	Pedagogy: Chalk and Talk, PPT, Simulations
	RBT Level: Theory: K2, K3

MODULE II	**FOURIER SERIES AND FOURIER TRANSFORM**	**Periods**	9 Hrs

Fourier series representation of continuous-time periodic signals – Properties of Fourier series – Fourier transform – Properties – Parseval's theorem – Time and frequency shifting – Differentiation and integration – Convolution theorem – Applications in communication systems.

Teaching Learning Process	Pedagogy: Chalk and Talk, PPT, Problem solving
	RBT Level: Theory: K2, K3

MODULE III	**LAPLACE TRANSFORM**	**Periods**	9 Hrs

Laplace transform – Region of convergence – Properties – Inverse Laplace transform – Partial fraction expansion – Analysis of LTI systems using Laplace transform – Transfer function – Stability analysis – Pole-zero plots. Hilbert Transforms

Teaching Learning Process	Pedagogy: Chalk and Talk, PPT, Problem solving
	RBT Level: Theory: K2, K3

MODULE IV	**DISCRETE-TIME FOURIER ANALYSIS**	**Periods**	9 Hrs

Discrete-Time Fourier Series (DTFS) – Properties – Discrete-Time Fourier Transform (DTFT) – Properties – Relationship between DTFT and CTFT – Sampling theorem – Aliasing – Reconstruction of continuous-time signals.

Teaching Learning Process	Pedagogy: Chalk and Talk, PPT, MATLAB demonstrations
	RBT Level: Theory: K2, K3

MODULE V	**Z-TRANSFORM**	**Periods**	9 Hrs

Z-transform – Region of convergence – Properties – Inverse Z-transform – Analysis of discrete-time LTI systems – Transfer function – Stability analysis – Relationship between Laplace transform and Z-transform – Applications in digital signal processing.

Teaching Learning Process	Pedagogy: Chalk and Talk, PPT, Problem solving, Case studies
	RBT Level: Theory: K2, K3, K4

Total	**Periods**	**45** Hrs

Suggested Activities and Evaluation Methods:

Tutorials, Problem solving Through MATLAB simulations, Quiz/MCQ (GATE Related Questions), Case Study on signal processing applications, Model Exam, CAT,

Course Outcomes:

After the successful completion of this course, the student should be able to

CO1: Apply the concepts of classification and representation of continuous-time and discrete-time signals and systems to identify their characteristics and behavior.
CO2: Apply Fourier series and Fourier transform techniques to analyze continuous-time signals in time and frequency domains.
CO3Apply Laplace transform techniques to determine the transfer function, time response, and stability of continuous-time LTI systems.
CO4: Apply Discrete-Time Fourier Series (DTFS) and Discrete-Time Fourier Transform (DTFT) to analyze discrete-time signals and sampling effects.

CO5: Analyze discrete-time LTI systems using Z-transform methods to determine system response, stability, and performance in digital signal processing applications.

Textbooks:

T1: Alan V. Oppenheim, Alan S. Willsky, 'Signals and Systems', 2nd Edition, Pearson, 2015
T2: Simon Haykin, Barry Van Veen, 'Signals and Systems', 2nd Edition, Wiley, 2007
T3. Chi-Tsong Chen, "Signals and Systems", 3rd Edition, Oxford University Press, 2023

References:

R1: B.P. Lathi, 'Principles of Signal Processing and Linear Systems', Oxford University Press, 2009
R2. Michael J. Roberts, Signals and Systems, 2nd Edition, McGraw-Hill Education, 2012.
R3. Ramesh Babu, R. Anandanatarajan, Signals and Systems, Scitech Publications, Chennai.

Web links and Video Lectures (e-Resources):

1. NPTEL: Signals and Systems - https://nptel.ac.in/courses/108104100 2. MIT OCW: Signals and Systems - https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-003-signals-and-systems-fall-2011/
2. NPTEL – Principles of Signals and Systems (IIT Kanpur & others) https://onlinecourses.nptel.ac.in/noc24_ee36/preview
3. MIT Open Course Ware – Signals and Systems (Video Lectures) https://ocw.mit.edu/courses/res-6-007-signals-and-systems-spring-2011/video_galleries/video-lectures/
4. Swayam – Signals and Systems Course (Free Online) https://www.getyoureducation.net/course/signals-and-systems-3

CO-PO & PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	2	3	-
CO2	3	3	2	-	-	-	-	-	-	-	2	3	2
CO3	3	3	2	-	-	-	-	-	-	-	2	3	2
CO4	3	3	2	-	2	-	-	-	-	-	2	3	2
CO5	3	3	3	-	2	-	-	-	-	-	2	3	3
AVG	3	2.8	1.8	0	0.8	0	0	0	0	0	2	3	1.8

1 – Low, 2 – Medium, 3 – High, '-' – No correlation

<table>
<tr><td colspan="6">DIGITAL SYSTEM ARCHITECTURE AND DESIGN</td></tr>
<tr><td colspan="6">(Common to ECE)</td></tr>
<tr><td colspan="2">Course Code:</td><td>25UECT33</td><td>Course Type:</td><td colspan="2">PC</td></tr>
<tr><td colspan="2">Teaching Periods / Week (L:T:P):</td><td>2:1:0</td><td>Credits:</td><td colspan="2">3</td></tr>
<tr><td colspan="2">Total Teaching Periods:</td><td>45</td><td>CAT + ESE Marks:</td><td colspan="2">40 + 60</td></tr>
<tr><td colspan="2">Teaching Department:</td><td colspan="4">Electronics and Communication Engineering</td></tr>
<tr><td colspan="6">Course Objectives:</td></tr>
<tr><td colspan="6">To understand advanced combinational and sequential circuit design
To learn hardware description languages (Verilog/VHDL)
To design and implement finite state machines
To understand programmable logic devices and FPGA architecture</td></tr>
<tr><td>MODULE I</td><td colspan="3">DESIGN OF COMBINATIONAL CIRCUITS</td><td>Periods</td><td>9 Hrs</td></tr>
<tr><td colspan="6">Review of combinational circuits –Arithmetic circuits: Carry look ahead adders, Parallel prefix, Multipliers, Dividers – Comparators – Parity generators and checkers – Hazards in combinational circuits – Hazard-free design.</td></tr>
<tr><td colspan="2">Teaching Learning Process</td><td colspan="4">Pedagogy: Chalk and Talk, PPT, Circuit simulations</td></tr>
<tr><td colspan="2"></td><td colspan="4">RBT Level: Theory: K2, K3</td></tr>
<tr><td>MODULE II</td><td colspan="3">SEQUENTIAL CIRCUITS DESIGN</td><td>Periods</td><td>9 Hrs</td></tr>
<tr><td colspan="6">Sequential circuit design – Mealy and Moore models – State reduction techniques – State assignment methods – Design of synchronous sequential circuits – Registers and counters – Ring counter – Johnson counter – Sequence generators and detectors.</td></tr>
<tr><td colspan="2">Teaching Learning Process</td><td colspan="4">Pedagogy: Chalk and Talk, PPT, Design exercises</td></tr>
<tr><td colspan="2"></td><td colspan="4">RBT Level: Theory: K2, K3, K4</td></tr>
<tr><td>MODULE III</td><td colspan="3">HARDWARE DESCRIPTION LANGUAGES</td><td>Periods</td><td>9 Hrs</td></tr>
<tr><td colspan="6">Introduction to Verilog HDL – Data types – Operators – Behavioral modeling – Data flow modeling – Structural modeling – Procedural statements – Tasks and functions – Test bench writing – Simulation and synthesis.</td></tr>
<tr><td colspan="2">Teaching Learning Process</td><td colspan="4">Pedagogy: Chalk and Talk, Lab demonstrations, Coding exercises</td></tr>
<tr><td colspan="2"></td><td colspan="4">RBT Level: Theory: K2, K3</td></tr>
<tr><td>MODULE IV</td><td colspan="3">FINITE STATE MACHINES</td><td>Periods</td><td>9 Hrs</td></tr>
<tr><td colspan="6">ASM charts – Design of controllers – Microprogrammed control – Algorithmic State Machine design – One-hot encoding – FSM optimization – Implementation using HDL – Applications in digital system design.</td></tr>
<tr><td colspan="2">Teaching Learning Process</td><td colspan="4">Pedagogy: Chalk and Talk, PPT, Design projects</td></tr>
<tr><td colspan="2"></td><td colspan="4">RBT Level: Theory: K3, K4</td></tr>
<tr><td>MODULE V</td><td colspan="3">PROGRAMMABLE LOGIC DEVICES</td><td>Periods</td><td>9 Hrs</td></tr>
<tr><td colspan="6">PLA, PAL, CPLD architecture – FPGA architecture – Xilinx and Altera FPGAs – Configuration technologies – Design flow for FPGAs – Timing analysis – Power optimization – Applications of FPGAs in embedded systems.</td></tr>
<tr><td colspan="2">Teaching Learning Process</td><td colspan="4">Pedagogy: Chalk and Talk, PPT, FPGA demonstrations</td></tr>
<tr><td colspan="2"></td><td colspan="4">RBT Level: Theory: K2, K3, K4</td></tr>
<tr><td colspan="4">Total</td><td>Periods</td><td>45 Hrs</td></tr>
<tr><td colspan="6">Suggested Activities and Evaluation Methods:</td></tr>
<tr><td colspan="6">Tutorials, Problem solving through HDL coding assignments, Model based learning (Modelling Memory system) Mini projects, Quiz/MCQ (GATE Related Questions), Model Exam, CAT</td></tr>
<tr><td colspan="6">Course Outcomes:</td></tr>
<tr><td colspan="6">After Successful completion of this course, the student should be able to</td></tr>
<tr><td colspan="6">CO1: Apply principles of combinational logic design to design and analyze advanced arithmetic circuits such as adders, multipliers, comparators, and hazard-free circuits.
CO2: Analyze and design synchronous sequential circuits using Mealy and Moore models, state reduction, and state assignment techniques.
CO3: Apply Verilog HDL concepts to develop, simulate, and synthesize digital system models.
CO4: Analyze, design, and implement finite state machines using ASM charts and HDL for control-oriented digital applications.
CO5: Analyze and implement digital designs on programmable logic devices such as CPLDs and FPGAs considering timing, power, and application requirements.</td></tr>
<tr><td colspan="6">Textbooks:</td></tr>
<tr><td colspan="6">T1: Morris Mano, Michael D. Ciletti, 'Digital Design', 6th Edition, Pearson, 2018
T2. Samir Palnitkar, Verilog HDL: A Guide to Digital Design and Synthesis, 2nd Edition, Pearson Education, 2003.</td></tr>
<tr><td colspan="6">References:</td></tr>
</table>

R1: John F. Wakerly, 'Digital Design: Principles and Practices', 5th Edition, Pearson, 2018
R2: Volnei A. Pedroni, "Circuit Design with VHDL", 3rd Edition, MIT Press, 2020
R3. Peter J. Ashenden, Digital Design: An Embedded Systems Approach Using Verilog, Morgan Kaufmann, 2008.
R4. Stephen Brown and Zvonko Vranesic, Fundamentals of Digital Logic with Verilog Design, McGraw-Hill Education, 2014.

Web links and Video Lectures (e-Resources):

1. NPTEL: Digital System Design - https://nptel.ac.in/courses/108105132
2. NPTEL – FPGA Based System Design   https://nptel.ac.in/courses/117108092
3. Xilinx (AMD) FPGA Documentation & Learning Resources
https://www.xilinx.com/support/documentation.html
4. Intel (Altera) FPGA Training & Documentation
https://www.intel.com/content/www/us/en/programmable/support/training.html

CO-PO & PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	-	-	-	-	-	-	-	2	3	2
CO2	3	3	3	-	-	-	-	-	-	-	2	3	2
CO3	3	2	3	-	3	-	-	-	-	-	3	3	3
CO4	3	3	3	2	2	-	-	-	-	-	3	3	3
CO5	3	3	3	2	3	-	-	-	2	-	3	3	3
AVG	3	2.8	2.8	0.8	1.6	0	0	0	0.4	0	2.6	3	2.6

1 – Low, 2 – Medium, 3 – High, '-' – No correlation

ELECTRONIC CIRCUITS

(Common to ECE)

Course Code:	25UECT34	**Course Type:**	PC
Teaching Periods / Week (L:T:P):	3:0:0	**Credits:**	3
Total Teaching Periods:	45	**CAT + ESE Marks:**	40 + 60
Teaching Department:	Electronics and Communication Engineering		

Course Objectives:

To understand the analysis of transistor amplifier circuits
To learn the design of multistage amplifiers and feedback circuits
To analyze oscillator circuits and their frequency stability
To understand power amplifiers and tuned amplifiers

MODULE I	**TRANSISTOR AMPLIFIERS**	**Periods**	9 Hrs
Small signal equivalent circuits of BJT and MOSFET – CE, CB, CC configurations – CS, CG, CD configurations –h-parameters- Hybrid-π model – High frequency analysis – Miller effect – Bandwidth estimation – Cascode amplifier – Current mirror circuits.			
Teaching Learning Process	Pedagogy: Chalk and Talk, PPT, Circuit simulations		
	RBT Level: Theory: K2, K3		
MODULE II	**MULTISTAGE AMPLIFIERS**	**Periods**	9 Hrs
Cascaded amplifiers – Direct coupled amplifiers – Darlington pair – Bootstrap amplifier – Differential amplifier – CMRR – Analysis of BJT and MOSFET differential amplifiers – Current source biasing – Active loads.			
Teaching Learning Process	Pedagogy: Chalk and Talk, PPT, Problem solving		
	RBT Level: Theory: K2, K3		
MODULE III	**FEEDBACK AMPLIFIERS**	**Periods**	9 Hrs
Feedback concepts – Types of feedback: Voltage-series, Voltage-shunt, Current-series, Current-shunt – Effect of feedback on gain, bandwidth, noise, and distortion – Stability of feedback amplifiers – Bode plots – Gain margin and phase margin.			
Teaching Learning Process	Pedagogy: Chalk and Talk, PPT, Design exercises		
	RBT Level: Theory: K2, K3, K4		
MODULE IV	**OSCILLATORS**	**Periods**	9 Hrs
Barkhausen criterion – RC oscillators: Phase shift, Wien bridge – LC oscillators: Hartley, Colpitts, Clapp – Crystal oscillators – Frequency stability – Voltage controlled oscillators (VCO) – Relaxation oscillators: Astable multivibrator.			
Teaching Learning Process	Pedagogy: Chalk and Talk, PPT, Circuit simulations		
	RBT Level: Theory: K2, K3		
MODULE V	**POWER AMPLIFIERS AND TUNED AMPLIFIERS**	**Periods**	9 Hrs
Classification of power amplifiers – Class A, B, AB, C amplifiers – Push-pull amplifiers – Efficiency calculations – Heat sink design – Tuned amplifiers – Single tuned and double tuned amplifiers – Stagger tuned amplifiers – Bandwidth and selectivity.			
Teaching Learning Process	Pedagogy: Chalk and Talk, PPT, Design problems		
	RBT Level: Theory: K2, K3, K4		
Total		**Periods**	**45** Hrs

Suggested Activities and Evaluation Methods:

Tutorials, Problem solving using Circuit simulations using SPICE, Quiz/MCQ Assignments, Model Exam, CAT, Case Studies , Book chapter writing.

Course Outcomes:

After Successful completion of this course, the student should be able to

CO1: Apply small-signal models of BJT and MOSFET to analyze CE, CB, CC, CS, CG, and CD amplifier configurations, including high-frequency effects and bandwidth estimation.
CO2: Apply design principles to analyze and implement multistage amplifier configurations such as cascaded, Darlington, bootstrap, and differential amplifiers with proper biasing and active loads.
CO3: Analyze feedback amplifiers using voltage/current feedback topologies to determine gain, bandwidth, noise, distortion, and stability parameters including Bode plots, gain margin, and phase margin.
CO4: Apply oscillator design techniques to develop RC, LC, crystal, and relaxation oscillators meeting specific frequency and stability requirements.
CO5: Analyze and design power amplifiers (Class A, B, AB, C, push-pull) and tuned amplifiers (single, double, stagger tuned) to achieve desired efficiency, bandwidth, and selectivity.

Textbooks:

T1: Adel S. Sedra et al., "Microelectronic Circuits", 8th Edition, Oxford, 2020
T2: Robert L. Boylestad, Louis Nashelsky, "Electronic Devices and Circuit Theory", 12th Edition, Pearson, 2019

References:

R1: Donald A. Neamen, "Microelectronics: Circuit Analysis and Design", 5th Edition, McGraw Hill, 2020
R2. Paul R. Gray et al., "Analysis and Design of Analog Integrated Circuits", 6th Edition, Wiley, 2024.
R3. Muhammad H. Rashid, "Microelectronic Circuits", 3rd Edition, Cengage, 2016

Web links and Video Lectures (e-Resources):

1. NPTEL: Analog Electronic Circuits - https://nptel.ac.in/courses/117106088
2. All About Circuits https://www.allaboutcircuits.com/
3. Electronics Tutorials – Amplifiers and Oscillators https://www.electronics-tutorials.ws/amplifier/amp_1.html
4. MIT OpenCourseWare – Electronic Circuits https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-002-circuits-and-electronics-spring-2007/

CO-PO & PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	-	-	-	-	-	-	-	2	3	2
CO2	3	3	3	-	-	-	-	-	-	-	2	3	2
CO3	3	3	3	2	-	-	-	-	-	-	2	3	3
CO4	3	3	3	2	-	-	-	-	-	-	3	3	3
CO5	3	3	3	2	-	-	-	-	-	-	3	3	3
AVG	3	3	2.8	1.2	0	0	0	0	0	0	2.4	3	2.6

1 – Low, 2 – Medium, 3 – High, '-' – No correlation

GREEN ELECTRONICS AND SUSTAINABILITY			
(Common to ECE)			
Course Code:	25UECT34	**Course Type:**	PC
Teaching Periods / Week (L:T:P):	3:0:0	**Credits:**	3
Total Teaching Periods:	45	**CAT + ESE Marks:**	40 + 60
Teaching Department:	Electronics and Communication Engineering		

Course Objectives:

To understand the environmental impact of electronic products
To learn sustainable design practices in electronics
To understand e-waste management and recycling
To explore energy-efficient electronic systems

MODULE I	**INTRODUCTION TO GREEN ELECTRONICS**	**Periods**	9

Environmental impact of electronics industry – Life cycle assessment – Carbon footprint of electronic products – Regulatory frameworks: RoHS, WEEE, REACH – Green design principles – Design for environment (DfE) – Eco-labeling and standards.

Teaching Learning Process	Pedagogy: Chalk and Talk, PPT, Case studies
	RBT Level: K2

MODULE II	**SUSTAINABLE MATERIALS AND MANUFACTURING**	**Periods**	9

Hazardous materials in electronics – Lead-free soldering – Halogen-free materials – Biodegradable materials – Green manufacturing processes – Cleaner production technologies – Water and energy conservation in manufacturing – Supply chain sustainability.

Teaching Learning Process	Pedagogy: Chalk and Talk, PPT
	RBT Level: K2, K3

MODULE III	**ENERGY-EFFICIENT ELECTRONIC SYSTEMS**	**Periods**	9

Power management techniques – Low power design methodologies – Energy harvesting technologies: Solar, Thermal, Vibration, RF – Power-aware computing –Smart grid technologies.

Teaching Learning Process	Pedagogy: Chalk and Talk, PPT
	RBT Level: K2, K3

MODULE IV	**E-WASTE MANAGEMENT**	**Periods**	9

E-waste generation and composition – Collection and segregation – Recycling technologies – Material recovery – Urban mining – Informal recycling sector – Health and environmental hazards – Extended producer responsibility (EPR) – Circular economy model.

Teaching Learning Process	Pedagogy: Chalk and Talk, PPT
	RBT Level: K2, K3

MODULE V	**SUSTAINABLE PRODUCT DESIGN AND INNOVATION**	**Periods**	9

Design for disassembly – Modular design – Design for recyclability – Product service systems – Remanufacturing – Green product innovation – Case studies: Fairphone, Dell's recycling program – Future trends in sustainable electronics – Green ICT applications.

Teaching Learning Process	Pedagogy: Chalk and Talk, PPT, Project-based learning
	RBT Level: K2, K3, K4

Total	**Periods**	**45**

Suggested Activities and Evaluation Methods:

Case studies, Mini projects on sustainable design, Group presentations, Quiz, CAT, Model Exam, Problem solving, Report writing , Book chapter writing.

Course Outcomes:

After Successful completion of this course, the student should be able to

CO1: Explain environmental impacts, life cycle assessment, carbon footprint, RoHS/WEEE/REACH regulations, green design principles, DfE, and eco-labeling in electronics.
CO2: Identify hazardous materials and apply lead-free soldering, halogen-free/biodegradable alternatives, green manufacturing, cleaner production, conservation techniques, and supply chain sustainability.
CO3: Describe power management, low-power methodologies, energy harvesting (solar/thermal/vibration/RF), power-aware computing, and smart grids; analyze their role in efficient systems
CO4: Discuss e-waste generation/composition, collection/recycling, urban mining, hazards, EPR, and circular models; evaluate management strategies
CO5: Explain disassembly/modular/recyclable design, remanufacturing, case studies (Fairphone/Dell), trends, and Green ICT; apply principles and create innovative sustainable products.

Textbooks:

T1: Sameer Prasad, 'Green Electronics/Green Bottom Line', Elsevier, 2014
T2: Oladele A. Ogunseitan, Julie M. Schoenung, 'Green Electronics Design and Manufacturing', CRC Press, 2012

References:

R1. John X. Wang, "Green Electronics Manufacturing", CRC Press, 2012

R2. Albert Sabban, "Green Electronics and RF Technologies", CRC Press, 2025
R3. Farkhanda Ana et al., "Sustainable Electronics: The Future Ahead", CRC Press, 2025
R4. IEEE 1680 Standards for Environmental Assessment

Web links and Video Lectures (e-Resources):

1. EPA Electronics Stewardship - https://www.epa.gov/smm-electronics
2. Green Electronics Council - https://greenelectronicscouncil.org/

CO-PO & PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	-	-	-	3	3	2	-	-	2	2	2
CO2	2	2	-	-	-	3	3	2	-	-	2	2	2
CO3	3	3	3	-	2	3	3	-	-	-	3	3	3
CO4	2	2	-	-	-	3	3	2	-	-	2	2	2
CO5	3	3	3	2	2	3	3	-	-	-	3	3	3
AVG	2.4	2.4	1.2	0.4	0.8	3	3	1.2	0	0	2.4	2.4	2.4

1 – Low, 2 – Medium, 3 – High, '-' – No correlation

PYTHON FOR ENGINEERS			
(Common to ECE)			
Course Code:	25UCSI35	**Course Type:**	ES (Engineering Science)
Teaching Periods / Week (L:T:P):	3 : 0 : 2	**Credits:**	4
Total Teaching Periods:	Theory: 45 + Practical: 30 = 75	**CAT + ESE Marks:**	50 + 50 = 100
Teaching Department:	Department of Computer Science and Engineering / Electronics and Communication Engineering		

Course Objectives:

1. To introduce fundamentals of algorithmic thinking and Python programming concepts.
2. To develop problem-solving skills using control structures and modular programming.
3. To impart knowledge on functions, recursion, and lambda expressions.
4. To enable data handling using strings, lists, tuples, and their operations.
5. To provide hands-on experience with dictionaries, sets, and NumPy for ECE applications.

MODULE I	**INTRODUCTION TO COMPUTING AND PYTHON FUNDAMENTALS**	**Periods: 9+6**

Problem Solving Strategies – Algorithmic Thinking – Flowcharts – Python Features – Variables – Data Types– Operators – Input/Output Statements – Type Conversion.

Applications: Resistor color code decoder, Ohm's law calculator, Binary-Decimal converter.

Practicals:
1. Programs using variables, data types, and operators
3. Resistor color code decoder
4. Ohm's law calculator with user input
5. Binary to Decimal and Decimal to Binary converter for digital electronics

Teaching Learning Process	Pedagogy: Chalk and Talk, PowerPoint Presentations, Live Coding Demonstrations, Hands-on Lab Sessions, Problem-Based Learning
	RBT Level: Theory: K1, K2 | Practical: K3

MODULE II	**CONTROL STRUCTURES AND FUNCTIONS**	**Periods: 9+6**

Selection Statements (if, if-else, elif, nested if) – Iteration Statements (while, for, nested loops) – Loop Control (break, continue, pass) – Pattern Printing.

Applications: Voltage divider calculator, LED ON/OFF simulation, Waveform generation (square, triangular).

Practicals:
1. Programs using conditional statements (Voltage divider calculator, LED ON/OFF simulation)
2. Loop-based programs (Fibonacci series, Prime number generator)
3. Function to calculate equivalent resistance (series/parallel combinations)
4. Frequency Band Identifier.
5. Prime Number Generator for Encryption Seeds

Teaching Learning Process	Pedagogy: Interactive Lectures, Code Walkthroughs, Peer Programming, Debugging Exercises, Mini Projects
	RBT Level: Theory: K2, K3 | Practical: K3, K4

MODULE III	**FUNCTIONS**	**Periods: 9+6**

Function Definition and Call – Arguments (Positional, Keyword, Default, Variable-length) – Return Statement – Scope of Variables – Recursion – Lambda Functions – Built-in Functions.

Applications: Series-parallel resistance calculator, Recursive GCD for signal processing, Quick mathematical operations.

Practicals:

1 Series and Parallel Resistance Calculator 2. Wavelength and Frequency Converter 3. Recursive Function for GCD and LCM 4. Thevenin Equivalent Calculator			
Teaching Learning Process		Pedagogy: Demonstrations, Collaborative Learning, Case Studies on Real ECE Data, Hands-on Exercises	
		RBT Level: Theory: K2, K3 | Practical: K3, K4	
MODULE IV	**STRINGS AND DATA STRUCTURES**		**Periods: 9+6**
Strings (Indexing, Slicing, Methods, Formatting) – Lists (Operations, Methods, Comprehension, Nested Lists) – Tuples (Operations, Packing, Unpacking). Applications: Parsing serial data, Storing ADC samples, Moving average filter, Component specification database.			
Practicals: 1. Serial Data Packet Parser using String Operations 2 Electronic Component Database using Nested Lists 3. Signal Peak Detector from Sample List			
Teaching Learning Process		Pedagogy: Project-Based Learning, Live Demonstrations, Code Review Sessions, Industry Case Studies	
		RBT Level: Theory: K2, K3 | Practical: K4, K5	
MODULE V	**DICTIONARIES, SETS AND MODULES**		**Periods: 9+6**
Dictionaries (Methods, Comprehension, Nested) – Sets (Operations, Methods) – Modules and Packages – Standard Library (math, random) – Introduction to NumPy. Applications: IC pin configuration lookup, Frequency band allocation, dB conversion module, Signal processing with NumPy arrays.			
Practicals: 1. Dictionary-based IC pin configuration lookup system 2. NumPy Array Operations for Signal Representation 3. Simple Waveform Generator using NumPy			
Teaching Learning Process		Pedagogy: Hands-on Lab Sessions, Real-world Problem Solving, Mini-Project Development, Peer Review	
		RBT Level: Theory: K3, K4 | Practical: K4, K5	
Total			**Theory: 45 + Practical: 30 = 75 Periods**
Suggested Activities and Evaluation Methods: • Tutorials and Programming Assignments • Mini Projects (Signal Generator, Data Logger, Component Calculator) • Quiz / MCQ (Programming Logic, GATE-related questions) • Case Study on Python in Embedded Systems and IoT • Lab Record and Viva-voce • Continuous Assessment Tests (CAT) • End Semester Examination (Theory + Practical)			
Course Outcomes:			
After successful completion of this course, the student should be able to: CO1: Recall Python basics and explain problem-solving, data types, operators; implement resistor decoders, Ohm's law, and binary converters. (K3) CO2: Demonstrate control structures and functions (recursion, lambda); develop waveform generators and resistance			

calculators. (K3)
CO3: Apply string, list, and tuple operations for sensor data processing and ADC filtering. (K3)
CO4: Utilize dictionaries, sets, and modules (NumPy) to create lookup tables and signal processing tools. (K4)
CO5: Implement file handling, exception management, and Tkinter GUIs for data logging and instrument control. (K4)

Textbooks:

T1: Reema Thareja, "Python Programming", 3rd Edition, Oxford, 2023.
T2: Allen B. Downey, "Think Python", 3rd Edition, O'Reilly, 2024.
T3: E. Balagurusamy, "Introduction to Computing and Problem Solving Using Python", McGraw Hill Education, 2016.

References:

R1: Charles R. Severance, "Python for Everybody", Latest Edition, 2023.
R2: Mark Lutz, , "Learning Python", 6th Edition, O'Reilly, 2024
R3: Kenneth A. Lambert, "Fundamentals of Python: First Programs", Cengage Learning, 2nd Edition, 2018.
R4: John V. Guttag, "Introduction to Computation and Programming Using Python", MIT Press, 3rd Edition, 2021.

Web Links and Video Lectures (e-Resources):

1. NPTEL: Programming in Python - https://nptel.ac.in/courses/106106182
2. NPTEL: Python for Data Science - https://nptel.ac.in/courses/106106212
3. Official Python Documentation - https://docs.python.org/3/
4. Real Python Tutorials - https://realpython.com/
5. Python for ECE Applications - https://www.circuitbasics.com/python-for-electronics/

CO-PO & PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	-	2	-	-	-	-	-	1	2	1
CO2	3	3	2	2	2	-	-	-	1	-	1	2	2
CO3	3	2	2	2	3	-	-	-	1	-	1	2	2
CO4	3	3	3	2	3	-	-	-	1	-	2	3	2
CO5	3	3	3	3	3	-	-	-	2	-	2	3	3
AVG	**3.0**	**2.6**	**2.2**	**2.3**	**2.6**	**-**	**-**	**-**	**1.3**	**-**	**1.4**	**2.4**	**2.0**

1 – Low, 2 – Medium, 3 – High, '-' – No correlation

DIGITAL SYSTEM ARCHITECTURE AND DESIGN LABORATORY			
(Common to ECE)			
Course Code:	25UECP31	**Course Type:**	PC
Teaching Periods / Week (L:T:P):	0:0:2	**Credits:**	1
Total Teaching Periods:	30	**IAT + ESE Marks:**	60 + 40
Teaching Department:	Electronics and Communication Engineering		

Course Objectives:

1. To implement combinational and sequential circuits using HDL
2. To simulate and verify digital designs using EDA tools
3. To implement designs on FPGA boards

Practical Exercises:	**Periods (9+6 hrs)**

1. Design and simulation of 4-bit adder/subtractor using Verilog
2. Design and simulation of 4-bit multiplier using Verilog
3. Design and simulation of code converters (BCD to Gray, Binary to BCD)
4. Design and simulation of 8:1 multiplexer and 3:8 decoder
5. Design and simulation of priority encoder and comparator
6. Design and simulation of flip-flops (JK, D, T) using Verilog
7. Design and simulation of 4-bit synchronous counter (up/down)
8. Design and simulation of 4-bit shift register with parallel load
9. Design and simulation of sequence detector (Mealy/Moore FSM)
10. Design and simulation of traffic light controller using FSM
11. Design and simulation of UART transmitter/receiver
12. Design and simulation of ALU (8-bit arithmetic and logic operations)
13. FPGA implementation of combinational circuits
14. FPGA implementation of sequential circuits

SOFTWARE/HARDWARE REQUIRED

1. Xilinx Vivado / Intel Quartus Prime
2. ModelSim / QuestaSim for simulation
3. FPGA Development Board (Xilinx Spartan/Artix or Intel Cyclone)

References:

1. Samir Palnitkar, 'Verilog HDL', 2nd Edition, Pearson, 2003
2. Peter J. Ashenden, 'Digital Design: An Embedded Systems Approach Using Verilog', Morgan Kaufmann, 2008
3. Xilinx Vivado Design Suite User Guide

Course Outcomes:

After Successful completion of this course, the student should be able to

CO1. Implement combinational circuits using Verilog HDL (K3 – Apply)
CO2. Implement sequential circuits, including counters and shift registers (K3 – Apply)
CO3. Analyze FSM-based digital controllers (K4 – Analyze)
CO4. Simulate digital designs using EDA tools (K3 – Apply)
CO5. Test designs on FPGA platforms (K3 – Apply)

CO–PO & PSO Mapping

CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PSO 1**	**PSO 2**
CO1	3	3	3	-	3	-	-	-	2	-	3	3	3
CO2	3	3	3	-	3	-	-	-	2	-	3	3	3
CO3	3	3	3	2	3	-	-	-	2	-	3	3	3
CO4	3	3	3	-	3	-	-	-	2	-	3	3	3
CO5	3	3	3	2	3	-	-	-	2	-	3	3	3
AVG	3	3	3	0.8	3	0	0	0	2	0	3	3	3

1–Low, 2–Medium, 3–High, '-' –No correlation

ELECTRONIC CIRCUITS LAB

(Common to ECE)

Course Code:	25UECP32	**Course Type:**	PC
Teaching Periods / Week (L:T:P):	0:0:2	**Credits:**	1
Total Teaching Periods:	30	**IAT + ESE Marks:**	60 + 40
Teaching Department:	Electronics and Communication Engineering		

Course Objectives:

1. To design and test transistor amplifier circuits
2. To analyze frequency response and feedback in amplifiers
3. To design and test oscillator circuits

Practical Exercises:	**Periods (9+6 hrs)**

PRACTICE EXERCISES:

1. Design and testing of CE amplifier – frequency response
2. Design and testing of CC amplifier (Emitter follower)
3. Design and testing of CS amplifier using MOSFET
4. Design and testing of two-stage RC coupled amplifier
5. Design and testing of differential amplifier – CMRR measurement
6. Design and testing of voltage series feedback amplifier
7. Design and testing of current series feedback amplifier
8. Design and testing of RC phase shift oscillator
9. Design and testing of Wien bridge oscillator
10. Design and testing of Colpitts oscillator
11. Design and testing of Hartley oscillator
12. Design and testing of Class A power amplifier
13. Design and testing of Class B push-pull amplifier
14. Simulation of amplifier circuits using SPICE

References:

1. Robert L. Boylestad, Louis Nashelsky, 'Electronic Devices and Circuit Theory', 11th Edition, Pearson, 2013
2. David A. Bell, 'Electronic Devices and Circuits Laboratory Manual', 5th Edition, Oxford, 2010

Course Outcomes:

After Successful completion of this course, the student should be able to

CO 1. **Implement** single-stage and multi-stage amplifiers (K3 – Apply)
CO 2. **Analyze** frequency response of amplifier circuits (K4 – Analyze)
CO 3. **Implement** feedback amplifier circuits (K3 – Apply)
CO 4. **Implement** various oscillator circuits (K3 – Apply)
CO 5. **Simulate** electronic circuits using EDA tools (K3 – Apply)

CO–PO & PSO Mapping

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	3	3	3	2	-	-	-	-	2	-	3	3	3
CO2	3	3	3	2	-	-	-	-	2	-	3	3	3
CO3	3	3	3	2	-	-	-	-	2	-	3	3	3
CO4	3	3	3	2	-	-	-	-	2	-	3	3	3
CO5	3	3	3	-	3	-	-	-	2	-	3	3	3
AVG	3	3	3	1.6	0.6	0	0	0	2	0	3	3	3

1–Low, 2–Medium, 3–High, '-' –No correlation

DESIGN THINKING LABORATORY			
(Common to ECE)			
Course Code:	25UECP33	**Course Type:**	PC (Professional Core)
Teaching Periods / Week (L:T:P):	0 : 0 : 2	**Credits:**	1
Total Teaching Periods:	30 Hours	**IAT + ESE Marks:**	60 + 40 = 100
Teaching Department:	Department of Electronics and Communication Engineering		
Course Objectives:			
1. To develop human-centered design thinking skills for identifying real-world problems in the ECE domain. 2. To apply the five phases of design thinking methodology (Empathize, Define, Ideate, Prototype, Test) to ECE applications. 3. To build and test functional prototypes of electronic systems addressing user needs. 4. To foster innovation, creativity, and entrepreneurial mindset through hands-on project development. 5. To enhance communication and presentation skills for effectively pitching design solutions.			
MODULE I	**UNDERSTANDING USERS AND DEFINING PROBLEMS**		**Periods: 14**
Introduction to Design Thinking: What is Design Thinking – History and significance – Comparison with traditional problem-solving – Human-centered design philosophy – The Five Phases overview: Empathize, Define, Ideate, Prototype, Test. Empathize Phase: Understanding user needs – Observation techniques – Conducting simple interviews – Creating Empathy Maps (Says, Thinks, Does, Feels) – Identifying pain points and opportunities. Define Phase: Synthesizing user insights – Crafting Point of View (POV) statements – Formulating "How Might We" (HMW) questions – Problem framing techniques.			
Practical Exercises:			
Exercise 1: Introduction to Design Thinking (4 Hours) • Watch and discuss case study: IDEO Shopping Cart Redesign • Group activity: Identify everyday problems that could benefit from design thinking • Deliverable: Reflection note on design thinking principles (1 page) Exercise 2: Empathy Mapping (4 Hours) • Select a user group (students, elderly, farmers, or healthcare workers) • Conduct brief interviews with 2–3 users • Create an Empathy Map capturing user perspectives • Deliverable: Empathy Map poster with key insights Exercise 3: Problem Definition Workshop (4 Hours) • Synthesize findings from empathy research • Develop a Point of View (POV) statement: [User] needs [Need] because [Insight] • Generate 5 "How Might We" questions • Deliverable: Problem Statement Document Exercise 4: Case Study Analysis (2 Hours) • Analyze a real-world design thinking success story (Apple, Airbnb, or GE Healthcare) • Identify how each phase was applied • Deliverable: Case study summary presentation			
	Pedagogy: Case Study Analysis, Group Discussions, Role Playing,		

Teaching Learning Process		Peer Learning RBT Level: K2 (Understanding), K3 (Applying)	
MODULE II	**IDEATION AND CONCEPTUAL PROTOTYPING**		**Periods: 16**

Ideate Phase: Divergent thinking principles – Brainstorming rules and techniques – Mind Mapping – SCAMPER method (Substitute, Combine, Adapt, Modify, Put to other uses, Eliminate, Reverse) – Concept evaluation and selection.

Prototype Phase: Purpose of prototyping – Types of prototypes: Low-fidelity vs High-fidelity – Paper prototyping techniques – Storyboarding – Creating simple mockups and models.

Test Phase: Basics of user testing – Gathering feedback – Iteration based on insights – Communicating design solutions – Introduction to design documentation.

Practical Exercises:

Exercise 5: Brainstorming and Ideation Sprint (4 Hours)

- Conduct structured brainstorming session (generate 15–20 ideas)
- Apply SCAMPER technique to refine ideas
- Create a Mind Map for solution exploration
- Deliverable: Ideation board with categorized ideas

Exercise 6: Concept Selection (2 Hours)

- Evaluate ideas using a simple Feasibility vs Impact matrix
- Select top 2 concepts for prototyping
- Deliverable: Concept selection sheet with justification

Exercise 7: Paper Prototyping (4 Hours)

- Create low-fidelity prototypes using paper, cardboard, or craft materials
- Design user interface sketches for the proposed solution
- Role-play user interactions with the prototype
- Deliverable: Paper prototype with user flow diagram

Exercise 8: Storyboarding (2 Hours)

- Create a 6–8 frame storyboard showing user journey with the solution
- Visualize the problem-solution scenario
- Deliverable: Storyboard poster

Exercise 9: Peer Testing and Feedback (2 Hours)

- Present prototypes to peer groups
- Collect structured feedback using simple questionnaires
- Identify areas for improvement
- Deliverable: Feedback summary with iteration notes

Exercise 10: Final Concept Presentation (2 Hours)

- Prepare a 5-minute pitch presenting the design journey
- Cover: Problem → User Insights → Ideas → Prototype → Learnings
- Deliverable: Presentation slides and concept poster

	Pedagogy: Hands-on Workshops, Design Sprints, Collaborative

Teaching Learning Process	Learning, Presentations RBT Level: K3 (Applying), K4 (Analyzing), K5 (Evaluating)
Total	**30 Periods**

Course Outcomes:

CO1: Understand the principles of design thinking and human-centered design approach.

CO2: Apply empathy techniques to identify user needs and define problem statements effectively.

CO3: Generate creative solutions using structured ideation methods like brainstorming and SCAMPER.

CO4: Develop low-fidelity prototypes and storyboards to visualize proposed solutions.

CO5: Communicate design concepts effectively through presentations and documentation.

Assessment Scheme:

Internal Assessment (60 Marks): Exercise Deliverables – 30 Marks | Prototype & Storyboard – 15 Marks | Final Presentation – 15 Marks

End Semester Examination (40 Marks): Viva-voce on design thinking concepts and project work

Textbooks / References:

T1: Tim Brown, "Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation", Harper Business, 2009.

T2: IDEO.org, "The Field Guide to Human-Centered Design", IDEO, 2015. (Available free at designkit.org)

T3: Jeanne Liedtka and Tim Ogilvie, "Designing for Growth: A Design Thinking Tool Kit for Managers", Columbia University Press, 2011.

R1: Stanford d.school, "Design Thinking Bootleg", Hasso Plattner Institute of Design, 2018.

R2: Jake Knapp, "Sprint: How to Solve Big Problems and Test New Ideas in Just Five Days", Simon & Schuster, 2016.

R3: Don Norman, "The Design of Everyday Things", Basic Books, Revised Edition, 2013.

R4: Tom Kelley and David Kelley, "Creative Confidence", Crown Business, 2013.

Web Links and Video Lectures (e-Resources):

1. Stanford d.school Resources - https://dschool.stanford.edu/resources
2. IDEO Design Kit - https://www.designkit.org/
3. NPTEL: Design Thinking - A Primer - https://nptel.ac.in/courses/110104073
4. Coursera: Design Thinking for Innovation - https://www.coursera.org/learn/uva-darden-design-thinking-innovation
5. Arduino Project Hub - https://create.arduino.cc/projecthub
6. Figma Learn - https://help.figma.com/
7. Instructables - Electronics Projects - https://www.instructables.com/circuits/

CO-PO & PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	2	2	3	-	2	2	3	3	-	2	2	3
CO2	2	3	3	3	-	2	-	3	3	-	2	2	3
CO3	2	3	3	3	-	2	-	3	3	-	2	3	3
CO4	3	3	3	3	3	-	-	3	2	2	3	3	3
CO5	-	-	2	-	-	-	-	3	3	3	2	2	3
AVG	**2.3**	**2.8**	**2.6**	**3.0**	**3.0**	**2.0**	**2.0**	**3.0**	**2.8**	**2.5**	**2.2**	**2.4**	**3.0**

1 – Low, 2 – Medium, 3 – High, '-' – No correlation

PERSONALITY DEVELOPMENT SKILLS			
Common to all Branches			
Course Code:	25UHSP31	**Course Type:**	EEC
L : T : P:	1 : 0 : 0	**Credits:**	0 (Zero Credit)
Total Periods:	30 Hours	**Evaluation:**	Internal Assessment
Teaching Department:	Placement and Training Cell		
Prerequisite:	Basic proficiency in English communication, fundamental understanding of self-awareness		
Course Objectives:			
1. To develop a well-rounded personality by enhancing essential personal and professional skills. 2. To foster self-awareness, effective communication, and interpersonal abilities. 3. To build emotional intelligence, confidence, and leadership qualities. 4. To prepare students for interviews with resume building and behavioral skills. 5. To develop goal-setting strategies and professional workplace etiquette.			
MODULE I	**WORKPLACE ETIQUETTE AND MS OFFICE**	**Periods 6 Hrs**	
Workplace and Email Etiquette: Professional Behavior and Dress Code - Email Etiquette and Best Practices - Meeting Etiquette - Virtual Meeting Protocols. Microsoft Office Suite: MS Word (Document Creation, Formatting, Mail Merge) - MS Excel (Data Analysis, Functions, Charts) - MS PowerPoint (Creating Effective Presentations, Animation, Transitions).			
MODULE II	**BUSINESS COMMUNICATION AND SALES**	**Periods 6 Hrs**	
Business Communication: Verbal and Non-Verbal Communication - Written Communication in Business - Business Letters and Memos - Report Writing. Sales and Negotiations: Sales Techniques and Strategies - Negotiation Tactics and Styles - Persuasion Skills - Closing Techniques. Customer Service: Effective Communication Skills for Customer Service - Customer Support Channels and Tools - Handling Complaints and Feedback.			
MODULE III	**DECISION MAKING AND PROBLEM SOLVING**	**Periods 6 Hrs**	
Decision Making: Types of Decision Making - Decision Making Models and Techniques - Cognitive Biases - Risk Assessment and Management. Problem Solving: Problem Identification and Analysis - Root Cause Analysis - Creative and Critical Thinking Techniques - Implementation and Evaluation Techniques.			
MODULE IV	**INTERVIEW SKILLS AND BEHAVIORAL COMPETENCIES**	**Periods 6 Hrs**	
Interview Skills: Preparation and Research - Effective Communication and Presentation - Types of Interviews (HR, Technical, Behavioral). Resume Building: Resume Formats and Structure - Tailoring Resumes for Specific Jobs - Cover Letter Writing - LinkedIn Profile Optimization. Mannerism: Body Language - Professional Gestures - Respect and Courtesy in Interactions. Behavioral Skills: Emotional Intelligence - Adaptability and Flexibility - Stress Management in Professional Settings.			
MODULE V	**GROUP DISCUSSION AND MOCK INTERVIEWS**	**Periods 6 Hrs**	
Group Discussion: Effective Communication and Active Listening - Leadership and Participation Skills - Critical Thinking and Topic Analysis - GD Dos and Don'ts. Mock Interview: Common Interview Questions and Ideal Responses - STAR Method for Behavioral Questions - Feedback and Self Assessment - Video Interview Tips.			
Course Outcomes:			
After successful completion of this course, the student should be able to: CO1:Demonstrate professional workplace behavior and effectively use MS Word, Excel, and PowerPoint to create structured business documents, analyze data, and deliver presentations. CO2: Apply verbal, non-verbal, and written communication skills in business contexts, including report writing, sales strategies, negotiation techniques, and customer service interactions. CO3: Analyze business situations using decision-making models and problem-solving techniques to identify root			

causes and recommend appropriate solutions. CO4:Develop professional resumes, demonstrate effective interview communication, and exhibit appropriate mannerisms and behavioral skills in professional settings. CO5: Participate effectively in group discussions and mock interviews by applying critical thinking, structured responses (STAR method), and self-assessment techniques.
Textbooks:
T1: Barun K Mitra, "Personal Development and Soft Skills", Oxford Higher Education. T2: Stephen Covey, "Seven Habits of Highly Effective People", Simon & Schuster.
References:
R1: Sanjay Kumar & Pushp, "Communication Skills", Oxford Higher Education. R2: Nira Konar, "Communication Skills for Professionals", PHI Learning Pvt. Ltd. R3: H. Carnegie, *How to Win Friends and Influence People*, New York, NY, USA: Simon & Schuster, 1936 (Reprint 2009).
WEB RESOURCES 1. [Microsoft Support, “Microsoft Office Training Center.” [Online]. Available: https://support.microsoft.com/training. [Accessed: Jan. 28, 2026]. 2. Harvard Business Review, “Communication and Career Development Articles.” [Online]. Available: https://hbr.org. [Accessed: Jan. 28, 2026]. 3. NPTEL, “Soft Skills and Professional Communication,” IIT Courses. [Online]. Available: https://nptel.ac.in. [Accessed: Jan. 28, 2026]. 4. LinkedIn Learning, “Business Communication and Interview Preparation Courses.” [Online]. Available: https://www.linkedin.com/learning. [Accessed: Jan. 28, 2026].

INDIAN CONSTITUTION AND HUMAN RIGHTS

(Common to All Branches of UG Engineering Programs)

Course Code:		**Course Type:**	Mandatory Course (Audit)
Teaching Periods / Week (L:T:P):	2:0:0	**Credits:**	0 (Zero)
Total Teaching Periods:	30	**IAT + ESE Marks:**	Pass / Fail (Satisfactory / Unsatisfactory)
Teaching Department:	General Engineering		

Course Objectives:

To impart knowledge on:

1. Historical background, Preamble, and salient features of the Indian Constitution
2. Fundamental Rights, Directive Principles of State Policy, and Fundamental Duties
3. Structure and functioning of Union, State, and Local Self Governments
4. Universal Human Rights principles and international protection frameworks
5. Contemporary human rights issues and remedial mechanisms in India

MODULE I	**INTRODUCTION TO INDIAN CONSTITUTION**	**Periods: 6**

Historical Background: Making of the Constitution - Constituent Assembly and its key members - Draft Committee. Preamble: Philosophy and Core Values - Sovereign, Socialist, Secular, Democratic, Republic - Justice, Liberty, Equality, Fraternity. Salient Features of Indian Constitution: Written Constitution - Lengthy document - Blend of Rigidity and Flexibility - Federal Structure with Unitary Bias - Parliamentary System.

Instructional Activity

Timeline Activity on Constitutional History (or) Preamble Analysis Worksheet

Teaching Learning Process	Pedagogy: Interactive Lecture, Think-Pair-Share, Video-based Learning (Documentary on Constituent Assembly), Group Discussion
	RBT Level: Theory: K1, K2

MODULE II	**FUNDAMENTAL RIGHTS AND DUTIES**	**Periods: 6**

Fundamental Rights (Articles 12-35): Right to Equality (Art. 14-18) - Right to Freedom (Art. 19-22) - Right Against Exploitation (Art. 23-24) - Right to Freedom of Religion (Art. 25-28) - Cultural and Educational Rights (Art. 29-30) - Right to Constitutional Remedies (Art. 32): Writs - Habeas Corpus, Mandamus, Prohibition, Certiorari, Quo Warranto. Directive Principles of State Policy (Articles 36-51): Classification - Socialistic, Gandhian, Liberal-Intellectual Principles. Fundamental Duties (Article 51A): Citizen Responsibilities - 11 Duties. Relationship and Conflict between Fundamental Rights and Directive Principles.

Instructional Activity

Case Study Analysis on Landmark Supreme Court Judgments (or) Mock PIL Filing Exercise (or) Rights Violation Scenario Analysis

Teaching Learning Process	Pedagogy: Case Study Method, Role Play (Mock Court), Jigsaw Activity, Debate Session (FR vs DPSP), Scenario-based Learning, Problem-Based Learning
	RBT Level: Theory: K1, K2

MODULE III	**UNION AND STATE GOVERNMENT STRUCTURE**	**Periods: 6**

Union Executive: President - Election, Powers, Position - Vice-President - Prime Minister and Council of Ministers - Cabinet Committees. Union Legislature: Parliament - Lok Sabha and Rajya Sabha - Composition, Functions - Legislative Process - Bill to Act. State Executive: Governor - Chief Minister - State Council of Ministers. State Legislature: Legislative Assembly and Council - State Law-making Process. Centre-State Relations: Legislative, Administrative, and Financial Relations - Role of Finance Commission. Local Self Government: 73rd Amendment (Panchayati Raj) - 74th Amendment (Urban Local Bodies) - Three-tier System.

Instructional Activity

Flowchart Creation (Bill to Law) (or) Field Visit Report on Local Panchayat/Municipality

Teaching Learning Process	Pedagogy: Simulation Exercise, Collaborative Learning, Comparative Analysis (Venn Diagrams), Field Visit/Virtual Tour, Guest Lecture by Government Official
	RBT Level: Theory: K1, K2

MODULE IV	**HUMAN RIGHTS: CONCEPTS AND FRAMEWORKS**	**Periods: 6**

Evolution of Human Rights: Historical Development - Natural Rights Theory - Magna Carta - French Declaration - American Bill of Rights. Universal Declaration of Human Rights (UDHR) 1948: 30 Articles - Civil, Political, Economic, Social, Cultural Rights. International Human Rights Instruments: ICCPR - ICESCR - CEDAW - CRC - CAT - CERD. Human Rights in Indian Constitution: Part III and Part IV Provisions. National Human Rights Commission (NHRC): Composition - Functions - Powers - Procedure. State Human Rights Commissions - National Commission for Women, SC, ST, Minorities.

Instructional activities

NHRC Case Study Analysis

Teaching Learning Process	Pedagogy: Video Case Study, Seminar Presentation		
	RBT Level: Theory: : K1, K2 , K3		
MODULE V	**CONTEMPORARY HUMAN RIGHTS ISSUES**		**Periods: 6**

Rights of Vulnerable Groups: Women (POSH Act, Domestic Violence Act) - Children (POCSO, JJ Act) - Elderly (Maintenance Act) - Persons with Disabilities (RPWD Act 2016). Rights of Marginalized Communities: SC/ST (Prevention of Atrocities Act) - Minorities - LGBTQ+ (Navtej Singh Johar Case). Right to Information (RTI Act 2005): Provisions and Application. Right to Education (RTE Act 2009). Environmental Rights: Right to Clean Environment - Sustainable Development - PIL on Environmental Issues. Digital Rights: Right to Privacy (Puttaswamy Case) - Data Protection - Cyber Rights. Human Rights Violations and Remedies: Legal Aid - Grievance Redressal Mechanisms.

Instructional activities

RTI Application Drafting Workshop (or) Case Study on HR Violations

Teaching Learning Process	Pedagogy: Problem-Based Learning, Panel Discussion, RTI Workshop
	RBT Level: Theory: K1, K2 , K3
Total	**Periods: 30**

Suggested Activities and Evaluation Methods:

Active Learning: Case Studies, Role Play, Mock Court/Parliament, Group Discussions, Debates, Panel Discussions

Practical Activities: RTI Application Drafting, Field Visits to Panchayat/Municipal Offices,

Digital Tools: Kahoot Quizzes, Mentimeter Polls, Online Discussion Forums, Digital Portfolios

Assessment Methods: Entry/Exit Tickets, One-Minute Papers, Peer Review, Reflective Journals, Group Presentations

Evaluation: CAT, Model Exam, Continuous Assessment through Formative Activities, End-Semester Viva-voce/Written Test

Course Outcomes:

After successful completion of this course, the student should be able to:

CO1 Understand the historical background of the Indian Constitution, the role of the Constituent Assembly and Drafting Committee, the philosophy and core values of the Preamble, and the salient features of the Indian Constitution.

CO2 Describe the Fundamental Rights, Directive Principles of State Policy, and Fundamental Duties, including constitutional remedies and writs, and explain their relationship through judicial interpretations

CO3 Understand the structure, powers, and functions of the Union, State, and Local Self Governments, including legislative processes and Centre–State relations under the Indian Constitution.

CO4 Apply the concepts and principles of human rights to identify international human rights frameworks and analyze the role of constitutional and statutory bodies in human rights protection in India.

CO5 Apply constitutional provisions, laws, and remedial mechanisms to analyze contemporary human rights issues, including those related to vulnerable groups, digital rights, environmental rights, and grievance redressal systems

Textbooks:

T1: D.D. Basu, "Introduction to the Constitution of India", 24th Edition, LexisNexis, 2020.

T3: S.K. Kapoor, "Human Rights Under International Law and Indian Law", Central Law Agency, 2018.

References:

R1: Granville Austin, "The Indian Constitution: Cornerstone of a Nation", Oxford University Press, 2019.

R2: J.N. Pandey, "Constitutional Law of India", 57th Edition, Central Law Agency, 2020.

R3: P.M. Bakshi, "The Constitution of India", Universal Law Publishing, 2020.

Web Links and Video Lectures (e-Resources):

1. Constitution of India - https://legislative.gov.in/constitution-of-india
2. National Human Rights Commission - https://nhrc.nic.in
3. SWAYAM Course on Indian Constitution - https://swayam.gov.in
4. NPTEL Course on Constitution of India - https://nptel.ac.in

CO-PO & PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1						2	2				1		
CO2						3	3	1	1		2		
CO3						2	2	1			1		
CO4						3	2		2		2		
CO5						3	3	2	2		2		
AVG						2.6	2.4	1.3	1.7		1.6		

1 - Low, 2 - Medium, 3 - High

Syllabus
Semester IV

PROBABILITY AND RANDOM PROCESS FOR COMMUNICATION SYSTEMS

(Common to ECE)

Course Code:	25UMAT41		**Course Type:**	BS
Teaching Periods / Week (L:T:P):	3:1:0		**Credits:**	4
Total Teaching Periods:	60		**CAT + ESE Marks:**	40 + 60
Teaching Department:	Mathematics			
Course Objectives:				
To understand probability theory and random variables To learn probability distributions and their applications To analyze random processes for communication systems To apply statistical methods in signal analysis				
MODULE I	**PROBABILITY THEORY**		**Periods**	12
Probability axioms – Conditional probability – Bayes' theorem – Independent events – Combined experiments – Bernoulli trials – Random variables – Probability distribution function – Probability density function – Properties – Conditional distributions.				
Teaching Learning Process	Pedagogy: Chalk and Talk			
	RBT Level: Theory: K2, K3			
MODULE II	**PROBABILITY DISTRIBUTIONS**		**Periods**	12
Binomial, Poisson, Geometric, Uniform, Exponential, Gaussian distributions – Properties – Moment generating functions – Characteristic functions – Functions of random variables – Central limit theorem.				
Teaching Learning Process	Pedagogy: Chalk and Talk			
	RBT Level: Theory: K2, K3			
MODULE III	**TWO-DIMENSIONAL RANDOM VARIABLES**		**Periods**	12
Joint distributions – Marginal distributions – Conditional distributions – Independence – Covariance – Correlation coefficient – Regression – Transformation of random variables – Sum of random variables.				
Teaching Learning Process	Pedagogy: Chalk and Talk			
	RBT Level: Theory: K2, K3			
MODULE IV	**RANDOM PROCESSES**		**Periods**	12
Classification of random processes – Stationary processes – Wide-sense stationary (WSS) – Ergodic processes – Autocorrelation and cross-correlation functions – Properties – Power spectral density – Wiener-Khinchin theorem – Cross-power spectral density.				
Teaching Learning Process	Pedagogy: Chalk and Talk			
	RBT Level: Theory: K2, K3			
MODULE V	**ANALYSIS OF LINEAR SYSTEMS WITH RANDOM INPUTS**		**Periods**	12
Response of LTI systems to random inputs – Autocorrelation and PSD at output – White noise – Band-limited white noise – Noise equivalent bandwidth – Narrow band noise – Quadrature representation – Applications in communication systems.				
Teaching Learning Process	Pedagogy: Chalk and Talk			
	RBT Level: Theory: K2, K3, K4			
Total			**Periods**	**60**
Suggested Activities and Evaluation Methods:				
Tutorials, Quiz/MCQ (GATE Related Questions), MATLAB simulations, Problem solving sessions, CAT and Model Exam, case Studies				
Course Outcomes:				
After Successful completion of this course, the student should be able to				
CO1:Explain and apply the fundamental concepts of probability theory including axioms, conditional probability, Bayes' theorem, independence, random variables, and probability distributions to solve numerical problems. CO2:Describe and compute probabilities and statistical measures using Binomial, Poisson, Geometric, Uniform, Exponential, and Gaussian distributions, including moment generating functions and the Central Limit Theorem. CO3:Analyze joint, marginal, and conditional distributions of two-dimensional random variables and compute covariance, correlation, regression, and transformations of random variables. CO4:Explain the characteristics of random processes and evaluate autocorrelation, cross-correlation, and power spectral density for stationary and ergodic processes. CO5:Analyze the response of linear time-invariant (LTI) systems to random inputs and determine output autocorrelation and power spectral density for applications in communication systems.				
Textbooks:				
T1. Alberto Leon-Garcia, "Probability, Statistics, and Random Processes", 4th Edition, Pearson, 2017 T2. Henry Stark, John W. Woods, "Probability and Random Processes", 4th Edition, Pearson, 2011				
References:				

R1. Athanasios Papoulis, S. Unnikrishna Pillai, "Probability, Random Variables", 4th Edition, McGraw Hill, 2002
R2. Peyton Z. Peebles Jr., "Probability, Random Variables", 4th Edition, McGraw Hill, 2001
R3. Sheldon M. Ross, "Introduction to Probability Models", 12th Edition, Academic Press, 2019

Web links and Video Lectures (e-Resources):

1. Massachusetts Institute of Technology (MIT), “Introduction to Probability and Statistics,” MIT OpenCourseWare. [Online]. Available: https://ocw.mit.edu. [Accessed: Jan. 28, 2026].
2. NPTEL, “Probability and Random Processes,” IIT Madras. [Online]. Available: https://nptel.ac.in. [Accessed: Jan. 28, 2026].
3. Khan Academy, “Probability and Statistics.” [Online]. Available: https://www.khanacademy.org/math/statistics-probability. [Accessed: Jan. 28, 2026].
4. Coursera, “Probability and Statistics Courses.” [Online]. Available: https://www.coursera.org. [Accessed: Jan. 28, 2026].

CO-PO & PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	2	2	-
CO2	3	3	2	-	-	-	-	-	-	-	2	3	2
CO3	3	3	2	-	-	-	-	-	-	-	2	3	2
CO4	3	3	3	-	2	-	-	-	-	-	3	3	3
CO5	3	3	3	-	2	-	-	-	-	-	3	3	3
AVG	3	2.8	2	0	0.8	0	0	0	0	0	2.4	2.8	2

1 – Low, 2 – Medium, 3 – High, '-' – No correlation

MICROCONTROLLERS

(Common to ECE)

Course Code:	25UECT42	**Course Type:**	PC
Teaching Periods / Week (L:T:P):	2:1:0	**Credits:**	3
Total Teaching Periods:	45	**IAT + ESE Marks:**	40 + 60
Teaching Department:	Electronics and Communication Engineering		

Course Objectives:

To understand microcontroller architecture and programming To learn peripheral interfacing techniques To develop embedded system applications To explore ARM Cortex-M architecture

MODULE I	**8051 MICROCONTROLLER ARCHITECTURE**	**Periods**	9
8051 Architecture – Memory organization – Special function registers – I/O ports – Timers/Counters – Serial communication – Interrupt system – Power saving modes – 8051 assembly language programming – Addressing modes – Instruction set.			
Teaching Learning Process	Pedagogy: Chalk and Talk, PPT, Assembly programming exercises		
	RBT Level: Theory: K2, K3		
MODULE II	**8051 PROGRAMMING AND INTERFACING**	**Periods**	9
Embedded C programming for 8051 – Keil IDE – Data types and operators – Control structures – Functions – Arrays and pointers – Interfacing: LED, 7-segment display, LCD, Keypad, Stepper motor, DC motor, ADC, DAC, Sensors.			
Teaching Learning Process	Pedagogy: Chalk and Talk, Lab demonstrations, Coding exercises		
	RBT Level: Theory: K2, K3		
MODULE III	**AVR/ARDUINO MICROCONTROLLERS**	**Periods**	9
AVR ATmega328P architecture – Memory organization – GPIO programming – Timers and PWM – ADC – Serial communication: UART, SPI, I2C – Arduino platform – Arduino IDE – Arduino programming – Shield interfacing.			
Teaching Learning Process	Pedagogy: Chalk and Talk, Arduino demonstrations, Projects		
	RBT Level: Theory: K2, K3		
MODULE IV	**ARM CORTEX-M ARCHITECTURE**	**Periods**	9
ARM Cortex-M processor overview – Registers – Operating modes – Memory model – Exception handling – NVIC – ARM instruction set basics – Thumb-2 instruction set – Development tools – STM32 family overview.			
Teaching Learning Process	Pedagogy: Chalk and Talk, PPT, Demonstrations		
	RBT Level: Theory: K2, K3		
MODULE V	**EMBEDDED SYSTEM DESIGN**	**Periods**	9
Embedded system development life cycle – Hardware-software co-design – RTOS basics – Task scheduling – Inter-task communication – Power management – Low power design techniques – IoT applications – Case studies in embedded systems.			
Teaching Learning Process	Pedagogy: Chalk and Talk, PPT, Project-based learning		
	RBT Level: Theory: K2, K3, K4		
Total		**Periods**	**45**

Suggested Activities and Evaluation Methods:

Tutorials, Lab exercises, Mini projects, Quiz/MCQ (GATE Related Questions), Industry case studies, CAT and Model Exam, Model Based learning, Report Writing

Course Outcomes:

After Successful completion of this course, the student should be able to

CO1: Understand the architecture of the 8051 microcontroller including memory organization, special function registers, I/O ports, timers/counters, serial communication, interrupt system, power saving modes, and instruction set, and apply assembly language programming concepts. [K2: Understand]

CO2: Apply Embedded C programming concepts for the 8051 microcontroller using Keil IDE and interface peripherals such as displays, motors, ADC, DAC, and sensors for embedded applications. [K3: Apply]

CO3: Understand the architecture and features of AVR/Arduino microcontrollers and apply Arduino programming and peripheral interfacing techniques for basic embedded system projects [K2: Understand]

CO4: Understand the ARM Cortex-M architecture including registers, memory model, exception handling, NVIC, and instruction set basics, and apply development tools for embedded system design. [K2: Understand]

CO5: Apply embedded system design principles including hardware-software co-design, RTOS concepts, power management, and IoT applications to develop efficient embedded system solutions. [K3: Apply]

Textbooks:

T1: Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, 'The 8051 Microcontroller and Embedded Systems', 2nd Edition, Pearson, 2006

T2: Joseph Yiu, 'The Definitive Guide to ARM Cortex-M3 and Cortex-M4 Processors', 3rd Edition, Newnes, 2014

References:

R1: Raj Kamal, 'Embedded Systems: Architecture, Programming and Design', 3rd Edition, McGraw Hill, 2015

R2: *Michael Margolis*, **Arduino Cookbook**, 3rd Edition, O'Reilly Media, 2020.
R3: *Jonathan W. Valvano*, **Embedded Systems: Real-Time Interfacing to ARM Cortex-M Microcontrollers**, 1st Edition, Cengage Learning, 2014.

Web links and Video Lectures (e-Resources):

1. NPTEL: Embedded Systems - https://nptel.ac.in/courses/108102045
2. ARM Developer Documentation - https://developer.arm.com/documentation
3. https://www.tutorialspoint.com/embedded_systems/index.htm?utm
4. https://www.geeksforgeeks.org/computer-organization-architecture/introduction-of-embedded-systems-set-1/?utm

CO-PO & PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	2	3	2
CO2	3	3	3	2	2	-	-	-	-	-	3	3	3
CO3	3	3	3	2	3	-	-	-	-	-	3	3	3
CO4	3	2	-	-	-	-	-	-	-	-	2	3	2
CO5	3	3	3	3	3	-	-	-	2	-	3	3	3
AVG	3	2.6	1.8	1.4	1.6	0	0	0	0.4	0	2.6	3	2.6

1 – Low, 2 – Medium, 3 – High, '-' – No correlation

ANALOG AND DIGITAL COMMUNICATION

(Common to ECE)

Course Code:	25UECT43	**Course Type:**	PC
Teaching Periods / Week (L:T:P):	3:0:0	**Credits:**	3
Total Teaching Periods:	45	**IAT + ESE Marks:**	40 + 60
Teaching Department:	Electronics and Communication Engineering		

Course Objectives:

To understand analog modulation and demodulation techniques
To learn pulse modulation and digital communication fundamentals
To analyze noise performance of communication systems
To understand digital modulation techniques

MODULE I	**AMPLITUDE MODULATION**	**Periods**	9
Communication system model – Need for modulation – Amplitude modulation: DSB-FC, DSB-SC, SSB, VSB – Generation and detection methods – Frequency translation – Superheterodyne receiver – AM broadcasting standards. Noise performance of AM.			
Teaching Learning Process	Pedagogy: Chalk and Talk, PPT, Virtual lab Simulations		
	RBT Level: Theory: K2, K3		
MODULE II	**ANGLE MODULATION**	**Periods**	9
Frequency modulation – Phase modulation – Narrowband and wideband FM – Carson's rule – FM generation: Direct and indirect methods – FM demodulation: Discriminator, PLL – Pre-emphasis and de-emphasis – FM broadcasting standards – Noise performance of FM. Comparison of AM and FM.			
Teaching Learning Process	Pedagogy: Chalk and Talk, PPT, Physical Demonstration		
	RBT Level: Theory: K2, K3		
MODULE III	**PULSE MODULATION**	**Periods**	9
Sampling theorem – Aliasing – Sample and hold circuits – PAM, PWM, PPM – Time Division Multiplexing – Pulse Code Modulation – Quantization – Quantization noise – Companding – Differential PCM – Delta modulation – Adaptive delta modulation.			
Teaching Learning Process	Pedagogy: Chalk and Talk, PPT, MATLAB demonstrations, Problem-Based Activity		
	RBT Level: Theory: K2, K3		
MODULE IV	**DIGITAL MODULATION TECHNIQUES**	**Periods**	9
Baseband transmission – Line codes – Binary modulation: ASK, FSK, PSK, DPSK – Bandwidth efficiency – M-ary modulation: QPSK, 8-PSK, QAM – Constellation diagrams – Bit error rate analysis – Matched filter receiver – Inter-symbol interference.			
Teaching Learning Process	Pedagogy: Chalk and Talk, PPT, Virtual Lab Simulations		
	RBT Level: Theory: K2, K3		
MODULE V	**INFORMATION CODING THEORY**	**Periods**	9
Concept of information, units (bits, nats), entropy (marginal, joint, and conditional), mutual information, and information rate. Discrete Memoryless Sources (DMS).			
Teaching Learning Process	Pedagogy: Chalk and Talk, PPT, Problem solving		
	RBT Level: Theory: K2, K3, K4		
Total		**Periods**	**45**

Suggested Activities and Evaluation Methods:

Tutorials, MATLAB simulations, Quiz/MCQ , Design problems, CAT and Model Exam, Case Studies .

Course Outcomes:

After Successful completion of this course, the student should be able to

CO1: Discuss the communication system model, need for modulation, AM techniques, super heterodyne receiver, and AM broadcasting standards. [K3: Apply]

CO2: Describe FM and PM techniques, FM generation and detection methods, broadcasting standards, and comparison of AM and FM systems. [K3: Apply]

CO3: Explain sampling, pulse modulation techniques, PCM, delta modulation, quantization, and TDM in communication systems. [K3: Apply]

CO4: Analyze Discuss digital modulation techniques, line coding, M-ary modulation, BER performance, and inter-symbol interference. [K3: Apply]

CO5: Evaluate noise types, noise performance parameters, SNR analysis, and comparison of modulation systems in the presence of noise[K4: Analyze]

Textbooks:

T1: Simon Haykin, 'Communication Systems', 5th Edition, Wiley, 2009
T2: B.P. Lathi, Zhi Ding, 'Modern Digital and Analog Communication Systems', 5th Edition, Oxford University Press,

2019
References:
R1: John G. Proakis, Masoud Salehi, 'Communication Systems Engineering', 2nd Edition, Pearson, 2002 R2: Wayne Tomasi, 'Electronic Communications Systems', 5th Edition, Pearson, 2004 **R3:** Leon W. Couch II, *Digital and Analog Communication Systems*, 8th Edition, Pearson Education, 2013.
Web links and Video Lectures (e-Resources):
1. NPTEL: Analog Communication - https://nptel.ac.in/courses/117105132 2. NPTEL: Digital Communication - https://nptel.ac.in/courses/117105133 2. MIT OpenCourseWare – Communication Systems https://ocw.mit.edu 3. All About Circuits – Communication Systems Tutorials https://www.allaboutcircuits.com 4. IEEE Xplore Digital Library (Communication Systems articles) https://ieeexplore.ieee.org

CO-PO & PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	-	-	-	-	-	-	-	2	3	2
CO2	3	3	3	2	-	-	-	-	-	-	3	3	3
CO3	3	3	3	-	2	-	-	-	-	-	3	3	3
CO4	3	3	3	-	2	-	-	-	-	-	3	3	3
CO5	3	3	3	2	-	-	-	-	-	-	3	3	3
AVG	3	3	2.8	0.8	0.8	0	0	0	0	0	2.8	3	2.8

1 – Low, 2 – Medium, 3 – High, '-' – No correlation

TRANSMISSION LINES AND RADIATING SYSTEMS

(Common to ECE)

Course Code:	25UECT44	**Course Type:**	PC
Teaching Periods / Week (L:T:P):	3:0:0	**Credits:**	3
Total Teaching Periods:	45	**CAT + ESE Marks:**	40 + 60
Teaching Department:	Electronics and Communication Engineering		

Course Objectives:

To understand transmission line theory and characteristics
To learn impedance matching techniques
To analyze electromagnetic wave propagation
To understand antenna fundamentals and applications

MODULE I	**TRANSMISSION LINE THEORY**	**Periods**	9

ABCD parameters, Transmission line equations – Primary and secondary constants – Characteristic impedance – Propagation constant – Lossless and lossy lines – Reflection coefficient – Standing waves – VSWR – Input impedance – Power transfer – Quarter-wave transformer.

Teaching Learning Process	Pedagogy: Chalk and Talk, PPT, Problem solving
	RBT Level: Theory: K2, K3

MODULE II	**SMITH CHART AND IMPEDANCE MATCHING**	**Periods**	9

Smith chart construction – Applications of Smith chart – Single stub matching – Double stub matching – Quarter-wave matching – Broadband matching techniques – Transmission line resonators – Microstrip lines – Striplines.

Teaching Learning Process	Pedagogy: Chalk and Talk, PPT, Smith chart exercises, Virtual Lab Simulation
	RBT Level: Theory: K2, K3

MODULE III	**ELECTROMAGNETIC WAVE PROPAGATION**	**Periods**	9

Maxwell's equations – Wave equation – Plane waves in free space – Polarization – Poynting theorem – Wave propagation in conducting media – Skin effect – Reflection and transmission at boundaries – Ground wave propagation – Sky wave propagation – Space wave propagation.

Teaching Learning Process	Pedagogy: Chalk and Talk, PPT, Virtual Lab Simulations
	RBT Level: Theory: K2, K3

MODULE IV	**ANTENNA FUNDAMENTALS**	**Periods**	9

Radiation mechanism – Antenna parameters: Radiation pattern, Directivity, Gain, Effective area, Radiation resistance, Polarization, Bandwidth – Friis transmission equation – Antenna temperature – Half-wave dipole – Quarter-wave monopole – Loop antenna – Antenna arrays – Array factor.

Teaching Learning Process	Pedagogy: Chalk and Talk, PPT, Antenna simulation
	RBT Level: Theory: K2, K3

MODULE V	**ANTENNA TYPES AND APPLICATIONS**	**Periods**	9

Yagi-Uda antenna – Log-periodic antenna – Horn antenna – Reflector antennas: Parabolic dish, Cassegrain – Microstrip patch antenna – Slot antenna – Antenna measurements – Applications: Broadcasting, Satellite, Radar, Mobile communication.

Teaching Learning Process	Pedagogy: Chalk and Talk, PPT, Case studies, Antenna Construction Mini-Activity
	RBT Level: Theory: K2, K3, K4

Total	**Periods**	**45**

Suggested Activities and Evaluation Methods:

Tutorials, Smith chart exercises, Quiz/MCQ (GATE Related Questions), Antenna design assignments, Model Exam, CAT

Course Outcomes:

After Successful completion of this course, the student should be able to

CO1: Analyze transmission line parameters and wave behavior (K4 – Analyze)
CO2: Apply Smith chart for impedance matching problems (K3 – Apply)
CO3: Analyze electromagnetic wave propagation in different media (K4 – Analyze)
CO4: Calculate antenna parameters and radiation patterns (K3 – Apply / K4 – Analyze)
CO5: Select appropriate antennas for specific communication applications (K3 – Apply)

Textbooks:

T1: John D. Kraus, Ronald J. Marhefka, 'Antennas and Wave Propagation', 4th Edition, McGraw Hill, 2010
T2: David K. Cheng, 'Field and Wave Electromagnetics', 2nd Edition, Pearson, 2014

References:

R1: Constantine A. Balanis, 'Antenna Theory: Analysis and Design', 4th Edition, Wiley, 2016
R2: David M. Pozar, 'Microwave Engineering', 4th Edition, Wiley, 2011
R3: R. E. Collin, *Foundations for Microwave Engineering*, 2nd Edition, Wiley, 2001

Web links and Video Lectures (e-Resources):

1. **NPTEL Online Course – Transmission Lines and Electromagnetic Waves:** https://onlinecourses.nptel.ac.in/noc22_ee43/preview
2. **ANSYS Innovation Space – Transmission Line Theory** https://innovationspace.ansys.com/product/transmission-line-theory/
3. **PetroEdgeAsia – Transmission Lines: Design, Analysis & Applications (Training)** https://petroedgeasia.net/training/transmission-lines-design-analysis-and-applications-training-course/
4. **IITM Pravartak – Digital Skills Course on Electromagnetics/Transmission Lines** https://digitalskills.iitmpravartak.org.in/course_details.php?courseID=198&cart=
5. **CUTM Courseware – Electromagnetic Field Theory & Transmission Lines** https://courseware.cutm.ac.in/courses/electromagnetic-field-theory-transmission-lines/

CO-PO & PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	-	-	-	-	-	-	-	2	3	2
CO2	3	3	3	-	2	-	-	-	-	-	3	3	3
CO3	3	3	2	-	-	-	-	-	-	-	2	3	2
CO4	3	3	3	-	2	-	-	-	-	-	3	3	3
CO5	3	3	3	2	-	-	-	-	-	-	3	3	3
AVG	3	3	2.6	0.4	0.8	0	0	0	0	0	2.6	3	2.6

1 – Low, 2 – Medium, 3 – High, '-' – No correlation

CONTROL SYSTEMS

(Common to ECE, EEE)

Course Code:	25UECT45	**Course Type:**	ES
Teaching Periods / Week (L:T:P):	3:0:0	**Credits:**	3
Total Teaching Periods:	45	**CAT + ESE Marks:**	40 + 60
Teaching Department:	Electronics and Communication Engineering		

Course Objectives:

To understand the modeling of control systems To analyze time-domain and frequency-domain characteristics To learn stability analysis techniques To design controllers for desired specifications

MODULE I	**CONTROL SYSTEM MODELING**	**Periods**	9

Open-loop and closed-loop systems – Transfer function – Block diagram algebra – Signal flow graphs – Mason's gain formula – Mathematical modeling of electrical, mechanical, and electromechanical systems – Analogous systems.

Teaching Learning Process	Pedagogy: Chalk and Talk, PPT, Problem solving
	RBT Level: Theory: K2, K3

MODULE II	**TIME DOMAIN ANALYSIS**	**Periods**	9

Standard test signals – Time response of first and second order systems – Time domain specifications – Steady-state error – Static error constants – Effect of adding poles and zeros – Dominant poles – PID controller – Effects of P, I, D actions.

Teaching Learning Process	Pedagogy: Chalk and Talk, PPT, MATLAB simulations
	RBT Level: Theory: K2, K3

MODULE III	**STABILITY ANALYSIS**	**Periods**	9

Concept of stability – BIBO stability – Routh-Hurwitz criterion – Root locus technique – Rules for construction – Stability analysis using root locus. Introduction to lag and lead Compensation.

Teaching Learning Process	Pedagogy: Chalk and Talk, PPT, Problem solving
	RBT Level: Theory: K2, K3, K4

MODULE IV	**FREQUENCY DOMAIN ANALYSIS**	**Periods**	9

Frequency response – Bode plots – Gain margin and phase margin – Stability analysis – Polar plots – Nyquist stability criterion – Relative stability.

Teaching Learning Process	Pedagogy: Chalk and Talk, PPT, MATLAB demonstrations
	RBT Level: Theory: K2, K3, K4

MODULE V	**STATE SPACE ANALYSIS**	**Periods**	9

State space representation – State equations for electrical and mechanical systems – Transfer function from state model – Solution of state equations – State transition matrix – Controllability and observability.

Teaching Learning Process	Pedagogy: Chalk and Talk, PPT, Problem solving
	RBT Level: Theory: K2, K3, K4

Total	**Periods**	**45**

Suggested Activities and Evaluation Methods:

Tutorials, MATLAB simulations, Quiz/MCQ (GATE Related Questions), Design assignments, Model Exam, CAT

Course Outcomes:

After Successful completion of this course, the student should be able to

CO1: Model mathematical representations of physical systems (K3 – Apply)
CO2: Analyze time-domain response and steady-state errors (K4 – Analyze)
CO3: Determine system stability using Routh-Hurwitz and root locus methods (K4 – Analyze)
CO4: Analyze systems in frequency domain using Bode and Nyquist plots (K4 – Analyze)
CO5: Apply state space methods for system analysis and design (K3 – Apply)

Textbooks:

T1. Norman S. Nise, "Control Systems Engineering", 8th Edition, Wiley, 2020
T2. Katsuhiko Ogata, "Modern Control Engineering", 5th Edition, Pearson, 2010

References:

R1. Richard C. Dorf, Robert H. Bishop, "Modern Control Systems", 14th Edition, Pearson, 2022.
R2. I.J. Nagrath, M. Gopal, "Control Systems Engineering", 6th Edition, New Age, 2017
R3. Benjamin C. Kuo, Farid Golnaraghi, "Automatic Control Systems", 10th Edition, Wiley, 2014

Web links and Video Lectures (e-Resources):

1. NPTEL: Control Engineering – https://nptel.ac.in/courses/107106081
2. MIT OCW: Feedback Control Systems – https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-06-principles-of-automatic-control-fall-2012/
3. **Coursera – Control Systems courses list**: https://www.coursera.org/courses?query=control%20systems
4. **Coursera – Control Systems Analysis: Modeling of Dynamic Systems**: https://www.coursera.org/learn/modeling-feedback-systems

5. **Udemy – Control Systems Made Simple | Beginner's Guide**: https://www.udemy.com/course/control-systems-made-simple-modeling-simulation-control/
6. **MIT OpenCourseWare – Systems and Controls (Spring 2013)**: https://ocw.mit.edu/courses/2-04a-systems-and-controls-spring-2013/
7. **ISA – Process Automation and Control Courses** (includes feedback control topics): https://www.isa.org/training/training-courses-by-topic/process-automation-and-control-courses

CO-PO & PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	-	-	-	-	-	-	-	2	3	2
CO2	3	3	3	-	2	-	-	-	-	-	3	3	2
CO3	3	3	3	2	-	-	-	-	-	-	3	3	3
CO4	3	3	3	2	2	-	-	-	-	-	3	3	3
CO5	3	3	3	2	2	-	-	-	-	-	3	3	3
AVG	3	3	2.8	1.2	1.2	0	0	0	0	0	2.8	3	2.6

LINEAR INTEGRATED CIRCUITS

(Integrated Course: Theory + Practical)

(Common to ECE)

Course Code:	25UECI46	**Course Type:**	PC (Professional Core)
Teaching Periods / Week (L:T:P):	2 : 1 : 2	**Credits:**	4
Total Teaching Periods:	Theory: 45 + Practical: 30 = 75	**CAT + ESE Marks:**	40 + 60 = 100
Teaching Department:	Department of Electronics and Communication Engineering		

Course Objectives:

1. To understand operational amplifier characteristics, DC/AC parameters, and practical considerations.
2. To learn analog signal processing circuits using op-amps for various applications.
3. To design active filters (LPF, HPF, BPF, BSF) and oscillator circuits.
4. To understand waveform generators, timers, and PLL-based circuits.
5. To design and interface data converters (DAC/ADC) and voltage regulator circuits.

MODULE I	**OPERATIONAL AMPLIFIER FUNDAMENTALS**	**Periods: 9 + 6 Hrs**

Ideal and Practical Op-Amp Characteristics: Ideal op-amp assumptions - Practical deviations - Input and output impedance - Voltage gain - Bandwidth limitations. DC and AC Parameters: Input bias current - Input offset current - Input offset voltage - Thermal drift - Open-loop gain - Unity gain bandwidth - Gain bandwidth product.

Open-Loop and Closed-Loop Configurations: Open-loop operation - Negative feedback - Closed-loop gain - Virtual ground concept - Feedback factor.

Performance Parameters: Slew rate and its effects - CMRR (Common Mode Rejection Ratio) - PSRR (Power Supply Rejection Ratio) - Offset voltage and current compensation - Noise sources in op-amps.

Practical Exercises:

Experiment 1: Study of Op-Amp IC 741 - Pin Configuration and Specifications (2 Hours)

Experiment 2: Measurement of Op-Amp AC Parameters (2 Hours)

Experiment 3: Measurement of Slew Rate and CMRR (2 Hours)

Teaching Learning Process	Pedagogy: Chalk and Talk, PowerPoint Presentations, Datasheet Analysis, Lab Demonstrations, Circuit Simulations using LTSpice/Multisim
	RBT Level: Theory: K1, K2 (Remember, Understand) | Practical: K3 (Apply)

MODULE II	**OP-AMP APPLICATIONS**	**Periods: 9 + 6 Hrs**

Theory Content:

Basic Amplifier Configurations: Inverting amplifier - Non-inverting amplifier - Gain equations - Input and output impedance analysis.

Arithmetic Circuits: Summing amplifier (inverting and non-inverting) - Difference amplifier - Instrumentation amplifier

<table>
<tr><td colspan="4">(three op-amp configuration) - CMRR enhancement.
Signal Conditioning Circuits: Voltage follower (buffer) - Integrator circuit - Differentiator circuit - Practical considerations and frequency limitations.
Converters: Voltage-to-Current (V-to-I) converter - Current-to-Voltage (I-to-V) converter - Floating and grounded load configurations.
Non-Linear Applications: Precision half-wave and full-wave rectifiers - Peak detector - Log amplifier - Antilog amplifier - Analog multiplier using log-antilog technique.</td></tr>
<tr><td colspan="4">Practical Exercises:
Experiment 4: Inverting and Non-Inverting Amplifier Design (2 Hours)
Experiment 5: Summing Amplifier and Difference Amplifier (2 Hours)
Experiment 6: Integrator, Differentiator and Precision Rectifier (2 Hours)</td></tr>
<tr><td colspan="2" rowspan="2">Teaching Learning Process</td><td colspan="2">Pedagogy: Chalk and Talk, PowerPoint Presentations, Circuit Design Exercises, Hands-on Lab Sessions, Problem Solving</td></tr>
<tr><td colspan="2">RBT Level: Theory: K2, K3 (Understand, Apply) | Practical: K3, K4 (Apply, Analyze)</td></tr>
<tr><td>MODULE III</td><td colspan="2">ACTIVE FILTERS AND OSCILLATORS</td><td>Periods: 9 + 6 Hrs</td></tr>
<tr><td colspan="4">Active filters: First and second order LPF, HPF, BPF, BSF – Butterworth and Chebyshev response -State variable filter – Switched capacitor filter – Wien bridge oscillator – Phase shift oscillator – Quadrature oscillator – Voltage controlled oscillator (VCO).</td></tr>
<tr><td colspan="4">Practical Exercises:
Experiment 7: First and Second Order Low Pass Filter Design (2 Hours)
Experiment 8: Band Pass and Band Stop Filter Design (2 Hours)
Experiment 9: Wien Bridge and Phase Shift Oscillator (2 Hours)</td></tr>
<tr><td colspan="2" rowspan="2">Teaching Learning Process</td><td colspan="2">Pedagogy: Chalk and Talk, PowerPoint Presentations, Filter Design Projects, Simulation using FilterPro/MATLAB, Lab Experiments</td></tr>
<tr><td colspan="2">RBT Level: Theory: K2, K3, K4 (Understand, Apply, Analyze) | Practical: K3, K4 (Apply, Analyze)</td></tr>
<tr><td>MODULE IV</td><td colspan="2">WAVEFORM GENERATORS AND COMPARATORS</td><td>Periods: 9 + 6 Hrs</td></tr>
<tr><td colspan="4">Schmitt Trigger and application, Multivibrators using Op-Amp: Astable multivibrator - Frequency and duty cycle calculations - Monostable multivibrator - Pulse width control.
555 Timer IC: Internal block diagram - Monostable mode operation - Astable mode operation - PWM generation - Frequency and duty cycle design equations.</td></tr>
<tr><td colspan="4">Practical Exercises:
Experiment 10: Schmitt Trigger and Multivibrators using Op-Amp (2 Hours)
Experiment 11: 555 Timer - Astable and Monostable Modes (2 Hours)</td></tr>
<tr><td colspan="2" rowspan="2">Teaching Learning Process</td><td colspan="2">Pedagogy: Chalk and Talk, PowerPoint Presentations, Circuit Simulations, Timer/PLL Application Projects, Lab Experiments</td></tr>
<tr><td colspan="2">RBT Level: Theory: K2, K3 (Understand, Apply) | Practical: K3, K4 (Apply, Analyze)</td></tr>
<tr><td>MODULE V</td><td colspan="2">DATA CONVERTERS AND SPECIAL ICs</td><td>Periods: 9 + 6 Hrs</td></tr>
<tr><td colspan="4">Digital-to-Analog Converters (DAC): Weighted resistor DAC - R-2R ladder DAC - DAC specifications (resolution, accuracy, settling time, monotonicity)
Analog-to-Digital Converters (ADC): Flash (parallel) ADC - Successive Approximation Register (SAR) ADC - Dual slope (integrating) ADC - ADC specifications (resolution, conversion time, quantization error)
Sample and Hold Circuits: Principle of operation - Acquisition time - Droop rate - Aperture time.

Phase Locked Loop (PLL): Block diagram (Phase detector, LPF, VCO) - Operation principle - Capture range and lock range - Applications: FM demodulation, frequency synthesis, clock recovery.</td></tr>
<tr><td colspan="4">Practical Exercises:

Experiment 12: R-2R Ladder DAC using Op-Amp (2 Hours)
Experiment 13: ADC Interface using IC ADC0804 (2 Hours)
Experiment 14: PLL circuit (2 Hours)</td></tr>
<tr><td colspan="2"></td><td colspan="2">Pedagogy: Chalk and Talk, PowerPoint Presentations, Lab Experiments,</td></tr>
</table>

Teaching Learning Process	Interfacing Projects, Industry Application Case Studies	
	RBT Level: Theory: K2, K3, K4 (Understand, Apply, Analyze) | Practical: K3, K4 (Apply, Analyze)	
Total		**Theory: 45 + Practical: 30 = 75 Periods**

Suggested Activities and Evaluation Methods:

• Tutorials and Numerical Problem Solving
• Lab Exercises with Pre-lab and Post-lab Assignments
• Circuit Simulations using LTSpice/Multisim/Proteus
• Mini Projects: Audio Amplifier, Function Generator, Active Filter Module
• Quiz / MCQ (GATE Related Questions)
• Lab Record and Viva-voce
• Continuous Assessment Tests (CAT)
• Model Examination
• End Semester Examination (Theory + Practical)

Course Outcomes:

After successful completion of this course, the student should be able to:

CO1: Analyze op-amp characteristics including DC/AC parameters and select appropriate devices for specific applications. (K4 - Analyze)

CO2: Design and analyze various op-amp application circuits including amplifiers, converters, and signal conditioning circuits. (K4 - Analyze)

CO3: Design active filters (LPF, HPF, BPF, BSF) and oscillator circuits for specified frequency requirements. (K5 - Evaluate)

CO4: Design waveform generators, timer circuits, and PLL-based systems for signal generation and processing. (K4 - Analyze)

CO5: Interface and test DAC, ADC, and voltage regulator circuits for data acquisition and power management applications. (K4 - Analyze)

Textbooks:

T1. Sergio Franco, "Design with Op Amps and Analog ICs", 4th Edition, McGraw Hill, 2015
T2. D. Roy Choudhury, "Linear Integrated Circuits", 5th Edition, New Age, 2020
T3. Ron Mancini (TI), "Op Amps for Everyone", 5th Edition, Newnes, 2016.

References:

R1: Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", 4th Edition, McGraw Hill, 2015.

R2: Ramakant A. Gayakwad, "Op-Amps and Linear Integrated Circuits", 4th Edition, Pearson Education, 2000.

R3: Robert F. Coughlin and Frederick F. Driscoll, "Operational Amplifiers and Linear Integrated Circuits", 6th Edition, Pearson, 2001.

Web Links and Video Lectures (e-Resources):

1. NPTEL: Linear Integrated Circuits - https://nptel.ac.in/courses/117106088
2. Texas Instruments Training - https://training.ti.com/
3.Analog Devices University Program - https://www.analog.com/en/education.html
4. LTSpice Tutorials - https://www.analog.com/en/design-center/design-tools-and-calculators/ltspice-simulator.html

CO-PO & PSO Mapping

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	3	3	2	-	-	-	-	-	-	-	2	3	2
CO2	3	3	3	2	-	-	-	-	-	-	3	3	3
CO3	3	3	3	3	2	-	-	-	-	-	3	3	3
CO4	3	3	3	2	2	-	-	-	-	-	3	3	3
CO5	3	3	3	2	2	-	-	-	-	-	3	3	3
AVG	**3.0**	**3.0**	**2.8**	**2.3**	**2.0**	**-**	**-**	**-**	**-**	**-**	**2.8**	**3.0**	**2.8**

1 – Low, 2 – Medium, 3 – High, '-' – No correlation

MICROCONTROLLERS LAB (LAB Course)

(Common to ECE)			
Course Code:	25UECP41	**Course Type:**	PC
Teaching Periods / Week (L:T:P):	0:0:2	**Credits:**	1
Total Teaching Periods:	30	**IAT + ESE Marks:**	60 + 40
Teaching Department:	Electronics and Communication Engineering		

Course Objectives:

1. To program and interface peripherals with 8051 microcontroller
2. To develop applications using Arduino platform
3. To implement embedded system projects

Practical Exercises: — **Periods :30 Hrs**

PRACTICE EXERCISES:
1. 8051 Assembly programming: Arithmetic and logical operations
2. 8051 Assembly programming: Data transfer and bit manipulation
3. 8051 Timer programming: Delay generation and event counting
4. 8051 Serial communication: UART programming
5. Interfacing LED and 7-segment display with 8051
6. Interfacing 16x2 LCD with 8051
7. Interfacing 4x4 matrix keypad with 8051
8. Interfacing ADC (ADC0804) with 8051
9. Interfacing DAC (DAC0808) with 8051
10. Interfacing stepper motor with 8051 11.

Arduino programming: GPIO, ADC, PWM
12. Arduino interfacing: Sensors (temperature, ultrasonic, IR)
13. Arduino interfacing: LCD and serial communication

14. Mini project: IoT-based monitoring system using Arduino

References:

1. Muhammad Ali Mazidi, 'The 8051 Microcontroller and Embedded Systems', 2nd Edition, Pearson, 2006
2. Michael Margolis, 'Arduino Cookbook', 3rd Edition, O'Reilly Media, 2020

Course Outcomes:

After Successful completion of this course, the student should be able to

CO 1. Write assembly and C programs for 8051 microcontroller (K3 – Apply)
CO 2. Interface various I/O devices with 8051 (K3 – Apply)
CO 3. Implement timer and serial communication applications (K3 – Apply / K4 – Analyze)
CO 4. Develop Arduino-based embedded applications (K3 – Apply / K6 – Create)
CO 5. Design and implement IoT-based projects (K6 – Create)

CO–PO & PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	3	-	3	-	-	2		-	3	3	3
CO2	3	3	3	2	3	-	-	2		-	3	3	3
CO3	3	3	3	2	3	-	-	2		-	3	3	3
CO4	3	3	3	2	3	-	-	2		-	3	3	3
CO5	3	3	3	3	3	-	-	3		-	3	3	3
AVG	3	3	3	1.8	3	0	0	2.2	0	0	3	3	3

1–Low, 2–Medium, 3–High, '-' –No correlation

ANALOG AND DIGITAL COMMUNICATION LAB (LAB Course)			
(Common to ECE)			
Course Code:	25UECP42	**Course Type:**	PC
Teaching Periods / Week (L:T:P):	0:0:2	**Credits:**	1
Total Teaching Periods:	30	**IAT + ESE Marks:**	60 + 40
Teaching Department:	Electronics and Communication Engineering		

Course Objectives:

1. To implement analog modulation and demodulation techniques
2. To implement digital modulation schemes
3. To analyze communication system performance using simulation tools

Practical Exercises: **Periods : 30 Hrs**

PRACTICE EXERCISES:

1. Amplitude modulation and demodulation
2. DSB-SC modulation using balanced modulator
3. SSB generation and detection
4. Frequency modulation and demodulation
5. Pre-emphasis and de-emphasis circuits
6. PLL as FM demodulator
7. Sampling and reconstruction
8. Pulse Amplitude Modulation (PAM)
9. Pulse Code Modulation (PCM) encoding and decoding
10. Delta modulation and demodulation
11. ASK, FSK, PSK modulation and demodulation
12. QPSK modulation and demodulation
13. TDM and FDM implementation
14. MATLAB simulation of communication systems
15. BER Simulation of ASK , BPSK , FSK

References:

1. Simon Haykin, 'Communication Systems', 5th Edition, Wiley, 2009
2. Wayne Tomasi, 'Electronic Communications Systems', 5th Edition, Pearson, 2004

Course Outcomes:

After Successful completion of this course, the student should be able to

CO 1. Implement and analyze AM and FM modulation techniques (K3 – Apply / K4 – Analyze)
CO 2. Implement pulse modulation techniques (K3 – Apply)
CO 3. Implement digital modulation schemes (K3 – Apply)
CO 4. Analyze communication system performance (K4 – Analyze)
CO 5. Simulate communication systems using MATLAB (K3 – Apply)

CO–PO & PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	3	2	-	-	-	-	2	-	3	3	3
CO2	3	3	3	2	-	-	-	-	2	-	3	3	3
CO3	3	3	3	2	-	-	-	-	2	-	3	3	3
CO4	3	3	3	2	2	-	-	-	2	-	3	3	3
CO5	3	3	3	-	3	-	-	-	2	-	3	3	3
AVG	3	3	3	1.6	1	0	0	0	2	0	3	3	3

1–Low, 2–Medium, 3–High, '-' –No correlation

IDEA TO PROTOTYPE			
(Sustainability Focus - Mini Project)			
(Common to ECE)			
Course Code:	25UECW41	**Course Type:**	EEC (Employability Enhancement Course) / Mini Project
Teaching Periods / Week (L:T:P):	0 : 0 : 4	**Credits:**	2
Total Teaching Periods:	60 Hours (4 hrs/week × 15 weeks)	**IAT + ESE Marks:**	60 + 40 = 100
Teaching Department:	Department of Electronics and Communication Engineering		
Prerequisite:	25UECP33 - Design Thinking Laboratory (Semester III)		
Course Correlation with Design Thinking Laboratory:			
This course is a natural progression from the Design Thinking Laboratory (25UECP33) completed in Semester III. While Design Thinking introduced students to empathetic problem-solving and ideation, this course takes the journey forward—from idea to a tangible, functional prototype. Students will work in teams to identify real-world problems, develop innovative solutions, and build working prototypes using basic microcontroller platforms			
Course Objectives:			
1. To transform design thinking concepts into tangible, sustainable product solutions addressing real-world problems. 2. To develop skills in market research, technical feasibility analysis, and business model development. 3. To build functional Minimum Viable Products (MVPs) with focus on sustainability and SDG alignment. 4. To foster entrepreneurial mindset and understanding of product lifecycle from idea to Prototype. 5. To enhance teamwork, project management and documentation			
GUIDELINES		**30 hours**	
• Recap of Design Thinking methodology: Empathize → Define → Ideate → Prototype → Test • Introduction to UN SDGs: Goals, Targets, and Indicators • Mapping engineering solutions to SDGs (SDG 3: Health, SDG 6: Clean Water, SDG 7: Clean Energy, SDG 9: Industry & Innovation, SDG 11: Sustainable Cities, SDG 13: Climate Action) PHASE I: FOUNDATION & SDG ALIGNMENT PHASE II: IDEATION & CONCEPT DEVELOPMENT PHASE III: SYSTEM DESIGN & PLANNING PHASE IV: PROTOTYPING & DEVELOPMENT PHASE V : DOCUMENTATION			

ASSESSMENT SCHEME

Assessment Component	Weightage	Description
Phase-wise Deliverables	**30%**	Cumulative evaluation of reports, logs, and documents
Prototype Development	**30%**	Functionality, innovation, and build quality

Final Presentation & Demo	**20%**	Communication, demonstration, and Q&A handling
SDG Impact & Sustainability	**10%**	Alignment with SDG, environmental considerations
Team Collaboration & Peer Review	**10%**	Individual contribution and teamwork

Course Outcomes:

After Successful completion of this course, the student should be able to

CO1: Identify and articulate real-world problems aligned with UN Sustainable Development Goals.

CO2: Apply ideation techniques to generate innovative and feasible solution concepts.

CO3: Design system architecture and plan prototyping activities with appropriate resource allocation.

CO4: Develop functional prototypes using microcontroller-based systems with integrated hardware and software.

CO5: document projects while reflecting on sustainability impact and future scalability.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	3	3	3	-	3	2	2	2	-	3	3	3
CO2	3	3	3	3	2	3	-	3	-	2	3	3	3
CO3	3	3	3	3	3	-	-	3	-	2	3	3	3
CO4	-	2	2	2	-	3	2	2	-	3	3	2	3
CO5	-	-	-	-	-	-	2	3	3	-	2	2	3
AVG	**2.7**	**2.8**	**2.8**	**2.8**	**2.5**	**3.0**	**2.0**	**2.6**	**2.5**	**2.3**	**2.8**	**2.6**	**3.0**

1 – Low, 2 – Medium, 3 – High, '-' – No correlation

PROFESSIONALISM AND BASIC APTITUDE			
Common to all branches			
Course Code:	25UHSP41	**Course Type:**	Zero Credit (Audit)
L : T : P:	2 : 0 : 0	**Credits:**	0 (Zero Credit)
Total Periods:	30 Hours	**Evaluation:**	Internal Assessment
Teaching Department:	Placement and Training Cell		
Prerequisite:	English Communication and basic understanding of workplace behaviour		
Course Objectives:			
1. To help students improve communication, teamwork, and time management. 2. To teach professional behaviour and collaborative work skills. 3. To develop problem-solving and leadership skills. 4. To build foundational quantitative aptitude for competitive exams. 5. To prepare students for campus placement aptitude tests.			
MODULE I	**ATTITUDE, ADAPTABILITY AND VALUES**		**Periods: 6 Hrs**
Attitude: Positive Thinking and Optimism - Growth Mindset vs. Fixed Mindset - Self-Motivation and Initiative - Managing Negative Attitudes and Stress. Adaptability: Change Management - Cognitive Flexibility - Continuous Learning - Workplace Diversity Adjustment. Values: Personal vs. Professional Values - Integrity and Honesty - Respect and Empathy - Ethical Decision-Making. Perception and Learning: Sensory Perception and Attention - Factors Affecting Perception - Types of Learning - Learning Styles and Strategies.			
MODULE II	**LEADERSHIP AND CREATIVITY**		**Periods: 6 Hrs**
Leadership: Leadership Styles (Autocratic, Democratic, Laissez-faire) - Effective Communication for Leaders - Decision-Making - Team Motivation and Delegation. Creativity: Brainstorming Techniques - Innovation and Design Thinking - Problem-Solving Approaches - Imagination and Lateral Thinking. Reaching Your Potential: Self-Awareness Assessment - Goal Setting Frameworks - Time Management Techniques - Continuous Improvement Mindset.			
MODULE III	**GENERAL APTITUDE - NUMBER SYSTEMS**		**Periods: 6 Hrs**
Number System: Types of Numbers (Natural, Whole, Integer, Rational, Irrational) - Prime and Composite Numbers - Place Value and Face Value - Conversions between Number Bases (Binary, Octal, Decimal, Hexadecimal). HCF & LCM: Prime Factorization Method - Division Method - Relationship between HCF and LCM - Word Problems on HCF and LCM. Factorial Concepts: Definition and Notation of Factorial - Factorial Identities - Factorial in Permutations and Combinations - Trailing Zeros in Factorials.			
MODULE IV	**QUANTITATIVE APTITUDE - I**		**Periods: 6 Hrs**
Profit and Loss: Cost Price and Selling Price - Profit and Loss Percentage - Marked Price and Discount - Successive Transactions. Percentage, Ratio and Proportion: Percentage Basics and Calculations - Ratio Simplification and Comparison - Direct and Inverse Proportion - Percentage to Ratio Conversions. Simple Interest and Compound Interest: Simple Interest Formula and Calculation - Compound Interest Basics - Difference between SI and CI - Time and Rate-Based Problems.			
MODULE V	**PROBABILITY AND COMBINATORICS**		**Periods: 6 Hrs**
Probability: Basic Probability Concepts - Sample Space and Events - Independent and Dependent Events - Complementary Events. Permutation and Combination: Fundamental Principle of Counting - Permutations (nPr) - Combinations (nCr) - Circular Permutations. Pipe and Cistern: Inlet and Outlet Pipes - Filling and Emptying Time - Pipes Working Together - Alternate Inlet-			

Outlet Problems.	
Total	**Periods:30Hrs**
Course Outcomes:	
After successful completion of this course, the student should be able to: CO1: Apply positive attitude, adaptability, ethical values, and effective learning strategies for professional development. (K3 – Apply) CO2: Build leadership, creativity, and self-awareness to communicate effectively and solve problems. (K6 – Create) CO3: Apply number system concepts, HCF & LCM methods, and factorial principles to solve quantitative problems. (K3 – Apply) CO4: Calculate profit/loss, percentage, ratio, proportion, and interest problems for financial decisions. (K3 – Apply) CO5: Solve problems on probability, permutations, combinations, and pipe-cistern scenarios using logical reasoning. (K4 – Analyze)	
Textbooks:	
T1: Dr. R.S. Aggarwal, "Quantitative Aptitude for Competitive Exams", S. Chand Publishing. T2: Arun Sharma, "Quantitative Aptitude for CAT", Tata McGraw Hill.	
References:	
R1: Er. Deepak Agarwal & D.P. Gupta, "Rapid Quantitative Aptitude", Paramount Publications. R2: P.K. Mittal, "Numerical Ability and Quantitative Aptitude for Competitive Examinations", Arihant.	

<table>
<tr><td colspan="5">SDG & ENVIRONMENTAL SCIENCE</td></tr>
<tr><td colspan="5">(Mandatory Credit Course - MCC)</td></tr>
<tr><td colspan="5">(Common to All Branches)</td></tr>
<tr><td colspan="2">Course Code:</td><td>25UMCC41</td><td>Course Type:</td><td>MCC (Mandatory Credit Course)</td></tr>
<tr><td colspan="2">Teaching Periods / Week (L:T:P):</td><td>2 : 0 : 0</td><td>Credits:</td><td>0 (Zero Credit - Mandatory)</td></tr>
<tr><td colspan="2">Total Teaching Periods:</td><td>15 Hours</td><td>Evaluation:</td><td>Internal Assessment (Grade: S/U)</td></tr>
<tr><td colspan="2">Teaching Department:</td><td colspan="3">Department of Science and Humanities / All Departments</td></tr>
<tr><td colspan="2">Prerequisite:</td><td colspan="3">Basic awareness of environmental issues and social responsibility</td></tr>
<tr><td colspan="5">Course Objectives:</td></tr>
<tr><td colspan="5">1. To create awareness about the United Nations Sustainable Development Goals (SDGs) and their relevance to engineering.
2. To understand the fundamentals of environmental science including ecosystems, biodiversity, and natural resources.
3. To analyze environmental pollution, its causes, effects, and control measures.
4. To appreciate the role of engineers in sustainable development and green technologies.
5. To develop a sense of social and environmental responsibility among future engineers.</td></tr>
<tr><td>MODULE I</td><td colspan="3">INTRODUCTION TO SDGs AND SUSTAINABILITY</td><td>Periods: 06 Hrs</td></tr>
<tr><td colspan="5">Introduction to Sustainable Development: Definition and concept of sustainable development - Brundtland Commission Report (1987) - Three pillars of sustainability: Economic, Social, and Environmental. United Nations Sustainable Development Goals (SDGs): Overview of 17 SDGs and 169 targets - Adoption of 2030 Agenda - Global indicators for SDG monitoring.
India's Progress on SDGs: NITI Aayog SDG India Index - State-wise performance - National Action Plan.</td></tr>
<tr><td colspan="2" rowspan="2">Teaching Learning Process</td><td colspan="3">Pedagogy: Interactive Lectures, Video Presentations, Case Studies, Group Discussions on SDG Implementation</td></tr>
<tr><td colspan="3">RBT Level: K1 (Remember), K2 (Understand)</td></tr>
<tr><td>MODULE II</td><td colspan="3">ECOSYSTEMS AND BIODIVERSITY</td><td>Periods: 06 Hrs</td></tr>
<tr><td colspan="5">Ecosystem Fundamentals: Types of Ecosystems: Biodiversity: Definition and levels of biodiversity (Genetic, Species, Ecosystem) - Biodiversity hotspots - India as a mega-biodiversity nation - Endemic and endangered species. Threats to Biodiversity. Conservation of Biodiversity: Wildlife Protection Act, 1972 - Convention on Biological Diversity (CBD).
Relevance to SDGs: SDG 14 (Life Below Water) - SDG 15 (Life on Land).</td></tr>
<tr><td colspan="2" rowspan="2">Teaching Learning Process</td><td colspan="3">Pedagogy: Illustrated Lectures, Documentary Screenings, Field Visit Reports, Species Identification Activities</td></tr>
<tr><td colspan="3">RBT Level: K1 (Remember), K2 (Understand), K3 (Apply)</td></tr>
<tr><td>MODULE III</td><td colspan="3">NATURAL RESOURCES AND MANAGEMENT</td><td>Periods: 06 Hrs</td></tr>
<tr><td colspan="5">Renewable and non-renewable resources - Over-exploitation consequences. Water Resources: Global water distribution - Water crisis - Groundwater depletion - Water conservation techniques - Rainwater harvesting - Watershed management - Relevance to SDG 6 (Clean Water and Sanitation). Energy Resources: Conventional energy sources (Coal, Petroleum, Natural Gas) - Environmental impacts of fossil fuels - Renewable energy sources (Solar, Wind, Hydro, Biomass, Geothermal) - India's renewable energy targets - Relevance to SDG 7 (Affordable and Clean Energy).
Food Resources: World food problems - Modern agriculture impacts - Sustainable agriculture - Organic farming - Food security and SDG 2 (Zero Hunger).</td></tr>
<tr><td colspan="2" rowspan="2">Teaching Learning Process</td><td colspan="3">Pedagogy: Lectures with Real-world Examples, Energy Audit Exercises, Resource Mapping Activities, Guest Lectures from Industry</td></tr>
<tr><td colspan="3">RBT Level: K2 (Understand), K3 (Apply), K4 (Analyze)</td></tr>
<tr><td>MODULE IV</td><td colspan="3">ENVIRONMENTAL POLLUTION AND CONTROL</td><td>Periods: 06 Hrs</td></tr>
<tr><td colspan="5">Air Pollution: Sources and Effects on human health and environment. Water Pollution: Sources of water pollution,</td></tr>
</table>

Soil Pollution: Causes (Pesticides, Industrial waste, E-waste) - Effects on soil fertility and food chain - Bioremediation - Solid waste management (3R principle: Reduce, Reuse, Recycle). Noise Pollution, E-Waste and Plastic Pollution. Relevance to SDGs: SDG 3 (Good Health), SDG 11 (Sustainable Cities), SDG 12 (Responsible Consumption).			
Teaching Learning Process	Pedagogy: Lectures, Pollution Case Studies, Water/Air Quality Testing Demonstrations, Waste Audit Projects		
	RBT Level: K2 (Understand), K3 (Apply), K4 (Analyze)		
MODULE V	**CLIMATE CHANGE AND ROLE OF ENGINEERS**		**Periods: 06 Hrs**
Climate Change: Greenhouse effect - Global warming - Climate change impacts on India. Role of Engineers in Sustainability: Environmental Legislation in India: Relevance to SDGs: SDG 9 (Industry and Innovation), SDG 11 (Sustainable Cities), SDG 13 (Climate Action).			
Teaching Learning Process	Pedagogy: Lectures, Carbon Footprint Calculation, Green Technology Presentations, Industry Expert Sessions, Project-Based Learning		
	RBT Level: K2 (Understand), K3 (Apply),K4 (Analyze), K5 (Evaluate)		
Total			**Periods: 30 Hours**

Suggested Activities and Evaluation Methods:

- SDG Awareness Poster/Infographic Design
- Carbon Footprint Calculation Exercise
- Campus Waste Audit and Report
- Water/Energy Conservation Action Plan
- Documentary Screening and Reflection Writing
- Group Presentation on Assigned SDG
- Field Visit to Water Treatment Plant / Renewable Energy Facility
- Quiz / MCQ on Environmental Concepts
- Green Initiative Project Proposal

Evaluation: Internal Assessment only (Grade: Satisfactory (S) / Unsatisfactory (U))

- Attendance and Participation: 30%
- Assignments and Activities: 40%
- End-term Quiz/Presentation: 30%

Course Outcomes:

After successful completion of this course, the student should be able to:

CO1: Explain the concept of sustainable development and describe the 17 UN Sustainable Development Goals. (K2 - Understand)

CO2: Analyze ecosystem dynamics, biodiversity importance, and conservation strategies. (K4 - Analyze)

CO3: Evaluate natural resource management practices and their sustainability implications. (K5 - Evaluate)

CO4: Identify sources of environmental pollution and suggest appropriate control measures. (K3 - Apply)

CO5: Appreciate the role of engineers in addressing climate change and promoting sustainable development. (K5 - Evaluate)

Textbooks:

T1: Erach Bharucha, "Textbook of Environmental Studies for Undergraduate Courses", Universities Press, 2nd Edition, 2013.

T2: Anubha Kaushik and C.P. Kaushik, "Perspectives in Environmental Studies", New Age International, 6th Edition, 2018.

References:

R1: United Nations, "Transforming Our World: The 2030 Agenda for Sustainable Development", UN Publications, 2015.

R2: NITI Aayog, "SDG India Index and Dashboard", Government of India (Annual Reports).

R3: R. Rajagopalan, "Environmental Studies: From Crisis to Cure", Oxford University Press, 3rd Edition, 2016.

R4: Benny Joseph, "Environmental Studies", Tata McGraw Hill, 2nd Edition, 2012.

R5: IPCC Reports on Climate Change - https://www.ipcc.ch/

Web Links and Video Lectures (e-Resources):
1. UN Sustainable Development Goals - https://sdgs.un.org/ 2. NITI Aayog SDG India Index - https://sdgindiaindex.niti.gov.in/ 3. NPTEL: Environmental Science and Engineering - https://nptel.ac.in/courses/120108002 4. Ministry of Environment, Forest and Climate Change - https://moef.gov.in/ 5. Centre for Science and Environment (CSE) - https://www.cseindia.org/ 6. SWAYAM: Environmental Studies - https://swayam.gov.in/ 7. NASA Climate Change - https://climate.nasa.gov/ 8. World Wildlife Fund (WWF) - https://www.worldwildlife.org/

CO-PO & PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	-	-	-	-	-	2	2	2	-	-	2	-	2
CO2	-	-	-	-	-	3	3	2	-	-	2	-	2
CO3	-	-	-	-	-	3	3	2	-	-	3	-	2
CO4	1	-	2	-	-	3	3	2	-	-	2	2	2
CO5	2	-	2	-	2	3	3	3	-	-	3	2	3
AVG	**1.5**	**-**	**2.0**	**-**	**2.0**	**2.8**	**2.8**	**2.2**	**-**	**-**	**2.4**	**2.0**	**2.2**

1 – Low, 2 – Medium, 3 – High, '-' – No correlation